THE NEW HARBOR WORKS AT ANTWERP.

[From the Contract Journal.]

The following, was the condition of the port of Antwerp at the period when the works which form the subject of the present paper were commenced. There were first quay walls along the river having a total length of about 2,100 metres (7,000 ft.) secondly, four old creeks, still opening into the river; thirdly, the old docks of Napoleon, having an area of about 8 hectares (20 acres), connected to the Scheldt on one side and to the new docks on the other; fourthly, the four new docks, with an area of about 30 hectares (75 acres); fifthly, three dry docks for repairs. The total length of the quays within the docks was about 5,500 metres (21,300 ft. or 4 miles.) Most of these quays and a part of those on the river wall were in connection with railways; and several of them were occupied by sheds. In the last few years the erection of sheds and mechanical appliances has been largely extended. Steam and hydraulic traveling cranes, fixed cranes of great power, hydraulic machinery for working the lock gates and bridges, have been constructed, whilst the quays are connected with immense railway stations, having a total area of 31 hectares (77 acres), and a total length of sidings of 65 kilometres (40 miles); at the same time the docks are in direct communication with the Campine canal connecting the Meuse with the Scheldt.

Nevertheless, despite these large works, and the efforts made to utilize them to the utmost, their insufficiency for the present trade of the port became every day more evident. In addition, the quay walls on the river, constructed bit by bit on very irregular lines, were all adapted for any important trade. Except on the Quai du Rhin, there were no means of working these river walls by railways, and they could not even be approached at low water, their footing being laid at the low-water level; ships were obliged either to lie on the mud or keep at a distance from the walls. Finally the irregular form of the quays, a marked projection* which occurred about the middle of their length, and the necessity of providing projecting jetties, produced a retardation in the river currents, and in consequence deposits af sand and other inconveniences; while the ground available was insufficient for a complete and regular working of the traffic. It was therefore decided to reconstruct the whole of the quays upon a regular curve† concave towards the river. This curve is formed of several circular arcs tangential to each other, and has a total length of 3,500 metres (11,500 feet or 2·2 miles). At the same time the creeks which divided the then existing quays were to be replaced by large floating basins for smaller vessels. The docks being also insufficient, it was resolved to lengthen one of them, and to add three new dry docks to the three already existing. The new quays are being executed by the State, but will be furnished with the necessary appliances at the cost of the town; the other works on the docks are being executed by the Town alone. The portion to be provided by the State was contracted for in 1877 by Messrs. Couvreux and Hersent, of Paris, and comprised the following works:

First, the construction of a quay wall 3,500 metres long (2·2 miles), resting on a sound foundation, laid without any timber footings, and giving a depth of not less than 8 metres (26¼ ft.) of water against the face at low tide. In this wall are three recesses (see plan), rectangular in plan, which are intended to accommodate floating landing stages, and give access for boats. The landing stages will not project beyond the line of the quay, and will be made of iron, having a movable platform joined to the wharf by a movable bridge. Two of these landing stages are 20 metres long by 10 metres wide (66 ft. by 33 ft.); the other is 100 metres by 20 metres (330ft. by 66ft.).

Secondly, the construction, at the south end of this quay wall, of an embankment connecting it with the land. This embankment to be 650 metres long (2,130 ft.), and to be properly protected against the action of the river.

Thirdly, the construction of a basin for small craft,‡ having an area of about 4 hectares (10 acres), and divided into three parts: a lock 13 metres wide (42 ft.), connecting this basin with the Scheldt: and an entrance channel 50 metres wide (160 ft.).

Fourthly, the filling in necessary behind the new quay wall and in the creeks which were to be done away with, as well as the dredging required to maintain the full sectional area for the river throughout the period of executing the works.

The walls of the new quay and of the floating basin are calculated to stand a distributed load of six tons per square metre (11 cwt. per square foot), the load extending over the top of the wall itself and the quay space behind it.

* This is the Tête de Grue, shown about the middle of plan on page 145.

† This curve is shown by a thick line, marked "new line of quay wall," on accompanying plan. The thick dotted line shows the prolongation of the quay wall down stream, and also the line of wall on the left bank, which, though not included in the present contract, it is proposed ultimately to carry out.

‡ Shown at Section No. 1 of plan.

The works were divided into four sections, * the whole to be completed within six years and seven months from the commencement. They included the provision and fixing of twelve million kilogrammes (12,000 tons) of wrought iron for the caissons in the foundations, the landing stages, swing bridges, etc.; 375,000 cubic metres (490,000 cubic yards) of brick-work and concrete; 25,000 cubic metres (33,000 cubic yards) of masonry in Soignies stone, and more than 2½ million cubic metres (3,300,000 cubic yards) of earthwork in filling, dredging, etc. The cost is estimated at more than 38 million francs(£1,520,000),being augmented or diminished, according to an agreed schedule, with any augmentation or diminution in the depth of foundations which may have become advisable. To this will be added about 1,500,000 francs (£60,000) for additions to the foundations. The whole should be be completed about the commencement of 1884.

The above sketch is sufficient to show the important character of the works now under construction. The author describes briefly the first section of these works (which are constructed in front of the position occupied by the old southern citadel, now demolished), † and the methods employed by the contractors in their execution. This section of the works includes in the first place the new basins for small craft, which are already completed. They run parallel to the river, and are three in number. The central basin, from which branches the lock connecting them with the Scheldt, is 266.5 meters long and 65 meters wide (874 ft. by 213 ft.); the two others are respectively 246 and 225.5 meters long (807 ft. and 740 ft.); with a width of 50 meters (164 ft.). They are joined to the central basin by openings 10 meters wide (33 ft.); each crossed by a swing-bridge carrying a roadway 5¼ metres wide (17¼ ft.), and two footways, each of 1 meter (3¼ ft.). The bottom of the basin is 2 meters (6½ ft.) below the level of low water at Antwerp; and the coping of the walls 6.35 meters (21 ft.) above the same level. The total lengths of these walls is about 1,800 meters (5,900 ft. or 1⅛ mile). They rest at the bottom level on a layer of concrete 1 meter thick and 5 meters wide (3¼ ft. and 16½ ft.); enclosed by two rows of sheet piling. The wall, built of Broom bricks, is 8·35 meters high (27.4 ft.); including the coping, 4 meters wide at the base, and 2½ meters at the top (13.1 ft. and 8.2 ft.). The wall has a batter of 1 in 10, and is faced with hammer-dressed stone from the coping to a height of 2½ meters (8.2 ft.) above low water. The quay space of these basins has a width of 30 meters (98 ft.); it has been paved and has still to receive the necessary appliances for working. The walls are furnished with cast-iron mooring posts, with cast-iron fenders, and with wrought-iron ladders. The basins are kept filled to a level of about 3.6 meters above low water (12 ft.).

The lock between the central basin and the Scheldt has been built partly in the river and partly on dry ground. It is composed of three distinct portions. First, there is the upper lock, with a sill of masonry 0.3 meter (1 ft.) above the bottom of the basin, and resting on a foundation of concrete 2½ meters (8 ft.) thick. It has a width of 13 meters (42½ ft.) between the side walls; and is crossed by a wing-bridge 8½ meters wide (28 ft.), intended not only for horse traffic, but also for the railway which will serve the quays on the Scheldt. This lock was constructed between two rows of sheet piling, and behind an earthen coffer-dam connected at each end with the original banks of the river. It has a pair of gates opening inward, and is arranged for receiving, if necessary,another pair opening outward. Secondly, there is the lock chamber,75 metres long by 25 meters wide(246 ft.) by 82 ft.) Its walls are similar to those of the basins, but they are entirely faced with ashlar. The invert rests on a layer of concrete 1 meter thick (3.28 ft.), and its surface is 2 meters below low water (6.56 ft.) The whole is surrounded by sheet piling. Thirdly, there is the lower lock, which contains two pairs of gates, and has its invert level the same as that of the chamber. The side walls are 13 meters 42½ ft. apart, and are crossed by a swing-bridge of the same dimensions as that across the upper lock, and carrying a roadway and two lines of railway.

The chamber and lower lock had to be constructed almost entirely within the area of the Scheldt. Instead of building a coffer-dam in the river so as to proceed with both at the same time, the contractors proposed to make the lower lock itself form part of the coffer-dam which should shut in the lock chamber to be built behind it. With this object they constructed the whole of the lower lock *in situ*, and in one piece, upon an immense caisson sunk by means of compressed air to a depth of 6½ meters (21 ft.) below low-water level. This caisson was 40 by 23 meters (131 ft. by 75½ft.), having an area of 920 square meters (9,890 square ft). Its total height was 13 meters (42½ ft.), giving a content of 11,960 cubic meters (420,000 cubic ft.). Inside roof was divided longitudinally into five working chambers, completely independent of one another, each having its own air-lock and tubes for concrete. The walls of the caisson were joined near the top and above the girders by cross-girders of iron. The caisson was erected on the banks of the Scheldt, in a spot sheltered from the tide by an earthern embankment. When complete the embankment was cut through on the side near the river, and the tide entering floated off the caisson, which was then towed without any damage to its proper position. The sinking was commenced in August, 1878, and was finished by November of the same year. The masonary having been carried up a certain distance,it was then connected with the bank at either end by an earthen embankment. A vast basin was thus formed, which needed only to be pumped dry in order to commence the foundation of the lock chamber. When the chamber and locks were completed, all that remained was to remove the iron barrier across the end of the lower lock next the river by cutting the rivets and unbolting the wrought-iron knees which supported it.

The six gates belonging to the entrance lock are all of wrought-iron and made without rollers; the lowering of the water is effected by means of sluices in the side-walls and valves of the gates themselves. Between the lower lock and the line of the new quay is an entrance channel 50 meters long (164 ft.) and the same in width, intended to shelter boats from the river current as they enter or leave the lock. The bottom of this channel is 2½ meters (8 ft.) below low water; its walls were built upon caissons sunk by compressed air to depths varying from 10.5 to 12.6 meters below low water (34½ ft. to 41½ ft.), and in the manner to be described hereafter.

The embankment connecting the southern end of the new quay-wall with the banks of the Scheldt was finished in 1878. It is 650 meters in length (2,130 ft. or 0.4 mile), and is founded partly on rubble, partly on platforms of fascines loaded with stone; and stone is thrown in at the greater depths to form a sound footing for the embankment. This is constructed of an argillaceous alluvial earth called "schorre," and of sand dredged from the Scheldt; the river slope is paved with rough-hewn stone.

The new quays have now been constructed for a considerable distance both above and below the entrance to the basins already described. The filling in behind the walls has been performed partly by hopper barges discharging spoil dredged from the river, partly by locomotives bringing earth removed from the basins, and from lands acquired outside the works. The extent of this work may be judged from the fact that the quay head of the entrance channel to the basins is more than 150 meters (500 ft.) in front of the old dyke which formed the border of the river, and that two-thirds of the ground between the basins and the new quay wall has been won from the river-bed. Behind the basins extends the new southern quarter, occupying the site of the ancient Spanish citadel, and bought in 1874 by the Société Anonyme du Sud d'Anvers. It is intersected by wide streets, and is being covered with new buildings. Altogether it has an area of 115 hectares (284 acres); and to the south of it, close to the new fortifications, is the Southern Railway station, * having an area of 29 hectares (50 acres), and specially intended for the service of the new quays. At some future date it is probable that this station may be made to communicate with the left or western bank of the Scheldt by a bridge carrying a roadway and one or two lines of railway, which would be constructed by the State. Immediately above, or south of this bridge, in the corner between the railway and the fortifications, the town authorities intend to construct a small basin, dry at low water, and especially intended for barges carrying material for construction.† It will be 115 meters by 50 meters (377 ft. by 164 ft.), having a length of 340 meters of quay wall (1,115 ft. or 0.21 mile), and will be surrounded by a roadway 30 meters wide (100 ft.). Its entrance will be crossed by a swing bridge.

From the northern side of this entrance begins the quay wall, built within the bed of the river, and extending from thence in one curve to the old docks. This wall has been built by a special system of movable coffer-dams, which will be described immediately.

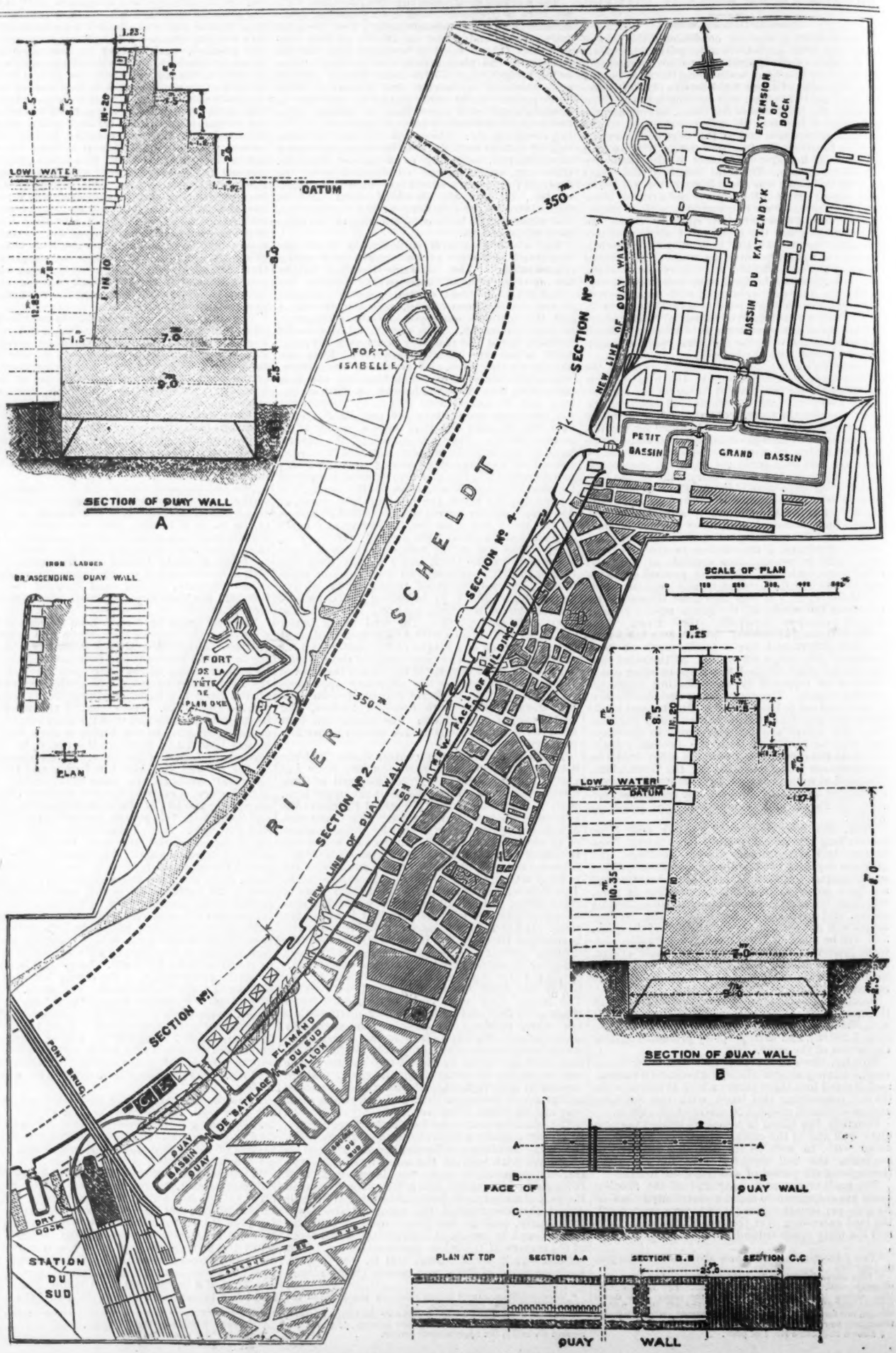
It is constructed of Broom bricks, and faced with Soignies stone; the coping level is 6.35 meters (21 ft.) above low water; the total height is 14.35 meters (47 ft.), and the width is 2 meters at the top (6.56 ft.), 6.25 meters at low water level (20½ ft.), and 7 meters at the base (23 ft.) It has a batter of 1 in 20 from the coping to low water level, and 1 in 10 from thence to the foundations. The upper of these foundations is carried throughout at a level of 8 meters (26¼ ft.) below low water, and has a breadth of 9 meters (29½ ft.); the depth

* These sections, shown in the plan, are numbered in the order of their being carried out.

† The site is occupied by the *Bassin de Batelage du Sud*, before referred to, and an entirely new quarter, of which the Square du Sud is the approximate center.

* Marked "Station du Sud" on plan.

† Marked "dry dock" on plan.



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varies between 2.50 and 5 meters (8¼ and 16½ ft.) according to the depth of the river bed and the nature of the soil, so that the bottom of the foundations is from 10.50 to 13 meters (34½ to 42¾ ft.) below low water.

The difficulty of carrying out such a work in the Scheldt is very great. The sandy and shifting nature of the bottom, the speed of the current and the great rise of tide are all adverse circumstances. It was required to build a continuous quay wall with its foundations 34 to 43 ft. below the low level of a rapid river, rising twice in the day to more than 13 ft. above this level and sometimes at high tide to 21 ft. The method adopted by the contractors was as follows: They divided the total length of the quays into lengths of 25 meters (82 ft. each), which have been built end to end and directly upon firm ground without any intervening foundations. This has been accomplished by means of a special coffer-dam used for the first time on this occasion and with most complete success. It is composed of the following parts:

First, an iron caisson for compressed air *A A*, Figs. 1 and 2, varying in height according to the depth at which the foundations are to be laid, and intended for removing the soil and laying the base of the wall.

Secondly, a movable iron coffer-dam *B B* 12 meters (40 ft.) high, having the same shape as the caisson on which it stands, and with which it is connected by bolts. Within this coffer-dam can be built, in the dry and in the open air, that part of the quay wall, 8 meters (26¼ ft.) in height, which is comprised between the top of the foundations properly, so called, and low water mark.

Thirdly, a floating framework *C C*, designed for the manipulation of the coffer-dam and the placing and sinking of the caisson.

The caisson serves for the removal of the earth, and is then filled with concrete and becomes an integral part of the foundation. The masonry having been built on the top of this, up to low water level, under the shelter of the coffer-dam, it becomes possible to remove the coffer-dam by unbolting it from the caisson and raising it by chains fixed to the floating frame work. It is then taken away to serve the same purpose for another length of wall, while the length so far constructed by its means is finished in the dry.

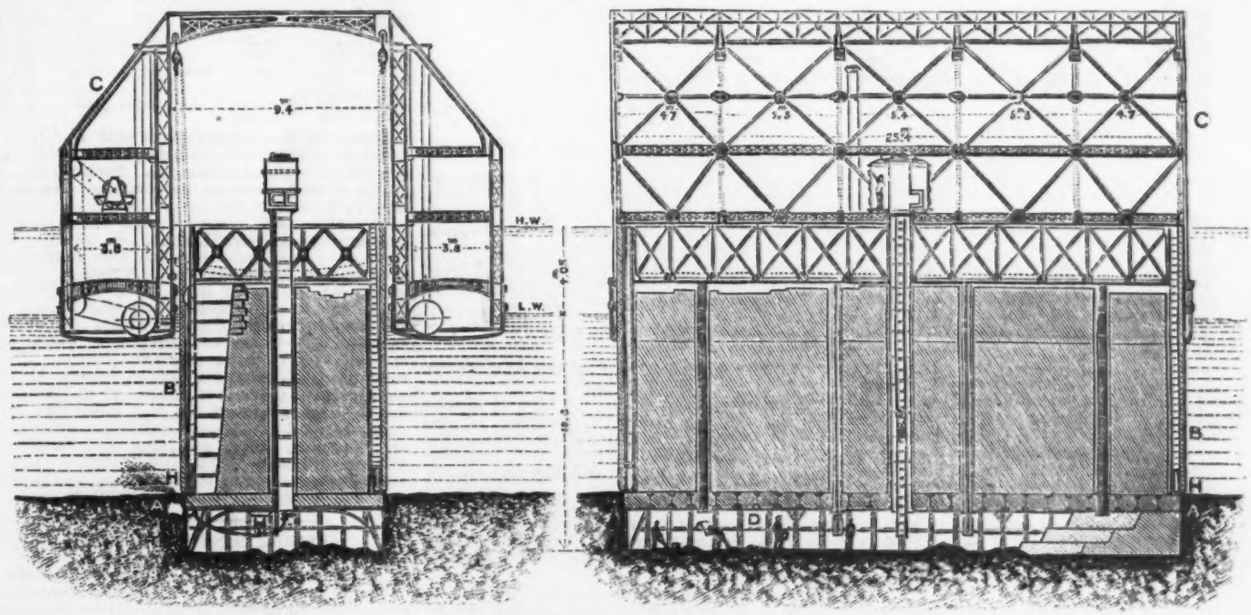
Such is the general plan of operations; a few details are subjoined.

The caissons *A A* have a uniform width of 9 meters (29½ ft.) and a length of 25 meters (82 ft.). Their height varies from 2.6 to 5 meters (8½ to 16½ ft.), according to the depth required, the footings of the wall, properly so-called, being, as already stated, always at a depth of 8 meters (26¼ ft.) below low water. Each caisson has vertical sides of plate-iron, riveted to longitudinal and transverse angle-irons. It is divided into an upper and a lower portion by a horizontal partition *D*; the lower portion forms the working chamber, and has a uniform height of 1.90 meters (6¼ ft.) from the lower edge to the roof. This roof is riveted to series of transverse lattice-girders, strong enough to support the load of masonry to be built upon the caisson, and at the same time to prevent any buckling of the sides. An angle-iron is riveted all around the external edge of the top of the caisson, and through this pass the bolts which connect it to the coffer-dam. The roof of the caisson has five circular openings in which are fixed wrought-iron tubes. Four of these are 0.5 meters in diameter (1.14 ft.), and are intended for the concrete, while the fifth, which is in the center, has a double air-lock for the workmen and for the compressed air. The masonry is so built as to leave around each of these tubes an annular space, so that they may be unbolted and withdrawn when the sinking is completed: the spaces are afterwards filled with concrete.

The caissons are built in yards on the river bank and are launched at high water; they are then towed to their destination under the movable coffer-dam, and are bolted to the latter, a layer of india rubber being placed between the two. The weight of a caisson 82 ft. by 29½ ft. varies from 65 to 100 tons, according as the height is 8¼ or 16½ ft.

The movable coffer-dam *B B* is composed of a large wrought-iron rectangular box, 25 metres by 9 meters (82×29½ ft.) and 12 meters (40 ft.) high. This height is sufficient to protect the interior against ordinary tides. The sides have a thickness varying from 6 mm. at the top to 12 mm. at the bottom (0.28 in. to 0.47 in.), and are stiffened externally by rolled girders and diagonals. Round the lower edge of the box runs a wrought-iron rectangular tube *H*, 1.50 meters high and 0.50 meters wide (4.92 and 1.64 ft.), through which a man can pass to bolt or unbolt the joint between the caisson and coffer-dam. There are four man-hole tubes, 1 meter by 0.5 meters (3.28×1.64 ft.) through any of which the workmen can enter; when within the bolts which connect it to the coffer-dam. Four Jablochkoff electric lamps are placed on each frame-work for working by night. The two barges, with their frame-work, engines, boilers, &c., weigh altogether about 300 tons.

The method of working with this apparatus is as follows: The site for the caisson is first dredged to the proper level; the caisson is then brought up to the floating frame-work, and its roof is loaded to the top of the girders with concrete, which ultimately forms part of the foundation. The coffer-dam is lifted until its bottom edge is about 1 meter (3.28 ft.) above the water level, and the caisson is then brought in under it: the coffer-dam is lowered upon it and the two are bolted together. The masonry is then commenced on the top of the caisson, so as to load it with the necessary weight, while at the same time the air tube and the four concrete tubes are attached to it. When the weight of masonry is sufficient to bring the lower edge of the caisson almost down to the river bottom at low-water, the whole structure, which weighs about 2,000 tons, is brought into the exact line of the quays and firmly moored. The masonry is then continued within the coffer-dam, whilst at the same time the working chamber at the bottom of the caisson is filled with compressed air; and as soon as the caisson rests upon the ground, with weight sufficient to resist the upward pressure, water is admitted inside the coffer-dam so as to increase the weight upon the caisson. The workmen then enter the working chamber and excavate the soil. As they do so the caisson sinks gradually until it reaches a firm foundation at the desired depth.



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The bottom of the Scheldt is generally composed of sand more or less argillaceous, and of loamy earth. Under these circumstances the work of removing the earth excavated has been considerably facilitated by the use of ejectors, as employed for the first time by the same contractors at Selzate Bridge on the Terneuzen Canal. For this purpose the earth is shovelled into an iron box fixed to the roof of the caisson; and a tube furnished with a stop-cock leads from this box to the exterior of the caisson, whilst a second tube opening into the box brings in water under a sufficient head to overcome the pressure of the compressed air. This water reduces the earth in the box to slush; the action being quickened if necessary by stirrers actuated by hand power. When the mixture is complete, the mere reversal of the two stop-cocks admits the compressed air to the ejector, which expels the slush through the side of the caisson. Each ejector can easily discharge two cubic meters (2.6 cu. yds.) of earth per hour. When the excavation is finished the working chamber is filled with concrete in regular layers through the four tubes mentioned. During the whole of this time the further loading of the coffer-dams is continued, with a sufficient quantity of materials to balance the increasing displacement caused by the sinking of the mass, and by the injection of the compressed air. When the working chamber is completely filled with concrete, the concrete tubes are removed, the water is pumped from inside of the coffer-dam, and the masonry in then continued up to a height of about half a meter (1.64 ft) above low water. The coffer-dam is then unbolted by means of workmen entering through the tube *H* previously described, which is filled with compressed air. The coffer-

dam is then lifted by the chains and winches, and taken to another caisson for a similar operation.

At first the putting in of the foundation for one 25 meter (82 ft.) length of wall, and the rasing of the masonry to low water level occupied 35 to 40 days; but the time has now been reduced to about 25 days.

The interposition of the sides of the coffer-dam leaves, of course, an interval of about 1 meter (3.28 ft.) wide, between the successive lengths of wall. The sides of this gap are temporarily closed by wooden sheetings; and the gap is then filled in with concrete thrown down under water up to the height of low water. Vertical grooves are left in the ends of the adjacent lengths of walling, and are filled in with concrete, which thus forms a sort of joggle between the two lengths of wall. Above low water the masonry is carried up by tidal work in a continuous length.

Throughout the whole length of the quays there will be two main-lines of railway, separated from a stretch of 20 meters wide by an iron railing; there will also be three lines of sidings for entire length. Iron sheds will occupy a width of 160 ft., and 4,600 lineal feet of these sheds have already been built; when completed these sheds will cover 25 acres.

The total cost of the quays, including machinery, earth works, dredging, paving, works above ground and property purchased will be about £3,200,000 ($16,000,000).

In addition to the above estimate the city has issued forms of tender for an extension of the docks towards the north, having a quay length of 2.8 miles, including property, these works will cost an additional sum of £800,000 ($4,000,000).

The author of the above paper is M. G. A. Royers, the *Ingénieur de la Ville* or City Engineer of Antwerp.

DAKOTA NAMES.

[Fargo (Dakota) Argus.]

In all parts of the country there are many names of towns, rivers and lakes which have come from the languages of the various Indian tribes. It would be a grand good thing if we could have these names all analyzed and the true meanings put upon record by competent authority. It is with much sorrow that I have noticed a strong tendency to attach fanciful and altogether false meanings to Indian names. It seems to be thought that all words of this character should have poetical meanings. That is not so. Indians are as practical and common sense people as we are. It is true, a name given by them has often a history. It commemorates some historical fact. In all such cases it would be well if the history could be preserved. The present writer has felt the importance of such a service and for years has had the thought of gathering such names as we have adopted from the language of Sioux. The number of them is not great. The following is put forth tentatively. There are others which have not come to my remembrance or knowledge. I will thank persons who are interested in this branch of study to send me names which they suppose to be of Dakota origin.

Anoka (anoka), both sides; the name of a town in Minnesota.

Chaska (caske), first-born boy; the name of a town on Rum River, Minnesota.

Chokia (cokaya), the middle; the name of a station on the road to Brown's Valley.

Cokato (cokata, pronounced chokahta), at the middle; the name of a town on the Manitoba Railroad. It is difficult to see how the metamorphosis of the name was made.

Dakota (dakota), alliance or league; the name of the Sioux Indians; also of a Territory that will soon be a State, and of various other places.

Eyota (iyotan), greatest, most; the name of a town near Rochester, Minn.

Itasca (not Dakota), the name of a lake in Minnesota in which the Mississippi River heads. It is said to have been formed by taking a part of each of the Latin words *veritas caput*.

Kandiyohi (kandi, buffalo fish, and iyohi, to reach to), the name of a lake and town in Central Minnesota.

Kasota (kasota), clear or cleared off, as the sky free from clouds; a small town in Minnesota.

Kewanee (kiwani), winter again, said of snow coming in the spring after the winter is supposed to be over; the name of a town in Illinois.

Mankato (maka and to), blue earth; a town on the Minnesota River.

Mazomanie (maza and omani), walking iron; the name of a town in Wisconsin, between Madison and Prairie du Chien.

Mendota (mdote), the mouth of a river or lake; originally the name of Gen. H. H. Sibley's trading post at the mouth of the St. Peters, and transferred from that to a number of other places.

Minneapolis (mini, water, ha, curling, and polis, Gr., city), City of the Water Falls. It is not absolutely certain how the "a" came into the word; but it is supposed to come from the Dakota rather than the Greek.

Minnehaha (minni and haha), curling water; it is allowable to translate it laughing water, a well-known cascade on Little Falls Creek, near Fort Snelling, Minnesota.

Minne inne-opa (mini and inonpa), second water; the name of a beautiful waterfall above Mankato; it is the lower of two near together, hence the Dakota name.

Minneiska (mini and ska), white or clear water; the name of a town on the Mississippi River in Minnesota. The Dakota name of the stream was Minneska; the "i" has no business there.

Minneopa, the same as Minneinneopa, a railroad station near Mankato.

Minneota (mini and ota), much water; the name of a station near Marshall, Minn.

Minnesota (mini and sota, water clear or slightly clouded), the name of the State and river. The latter was formerly called St. Peters.

Minnetonka (mini and tanka), great water; the name of a much frequented lake in Minnesota.

Otata (ojate), forks; the name of a station beyond Grand Forks.

Owatonna (owotanna), straight; the name of a town in Minnesota. The stream was called by the Dakotas "owotanna."

Shakopee (sakpe), six; the name of a town in Minnesota.

Sisseton (sisin and tonwanyan), fish-scale mound village; the name of one of the clans of the Sioux; also of a fort, and an Indian agency in Dakota.

Tintah (tinta), prairie, a station on the Manitoba Railroad.

Wabasna (wapahasa), a standard of battle; the name of a somewhat celebrated Dakota chief and village on the Mississippi River, in Minnesota; also the name of a town.

Wahpeton (Wahpetonwan), leaf village; the name of one of the Gentes of the Dakota people; a town in Dakota.

Waubay (wabe), a place of hatching; a town and lake west of Milbank.

Wayzata (waziyata), at the north; a railroad station on Lake Minnetonka.

Winona (winona), first born, if a daughter; the name of a city in Minnesota, and also one in Illinois and of various other places. It is said that Winona in Minnesota is pronounced Wynona. The one in Illinois is spelled Wenona.

Yankton (Ihanktonwan), end village; the name of the capital town of Dakota Territory. One of the Gentes of the Sioux nation.

MEXICAN LAND LAWS.

REGULATIONS TOUCHING REAL ESTATE DEALINGS BY FOREIGNERS.

The following abstract of the laws of Mexico regarding the acquisition by foreigners of real estate in Mexico is given in the San Antonia *Express*, and was compiled by Señor Don Francisco Gomez de Palacio, a lawyer, and now Governor of the State of Durango:

1. Foreigners, resident and domiciliated in the republic of Mexico can acquire there every class of immovable property, including mines of every kind, under the same rights the civil law establishes for Mexicans.

The following are the exceptions to the rule:

That to acquire lands situated within twenty leagues or less of any frontier of the republic a foreigner is required to obtain the permission of the president.

That no foreigner can acquire real property within five leagues or less of any seashore of the republic, not even with the permission of the president, unless under a special law giving him the privilege.

That no foreigner can locate any of the public lands of the nation, should he be a native or naturalized citizen of any country adjoining this republic, if such public lands are situated in any state or territory bounded by that.

The foreigner shall lose his rights to real estate he may have acquired in the republic under the following circumstances:

By absenting himself from the country, with his family, for two years, without permission of the government. Fines do not come under this rule. These we can hold even during his absence.

By residing outside of the republic, even although he should leave an attorney or agent authorized to sign his name. As alone, mines are excepted from this rule.

By transfer of the property, by inheritance, sale, or any other title, to a person not residing in the republic, mines excepted.

In all the above cases the property shall be sold, and the product of the sale delivered to the party holding the lands, with a deduction of 10 per cent.

If land has been acquired by a location of public lands, which shall not amount to over 2,500 hectares to each locator, the right to same shall be forfeited by failing to maintain on it one inhabitant for each 200 hectares. Such default accruing by failure to maintain such inhabitant for four months in any place.

The consequences following the acquisition of real estate by a foreigner in the Mexican republic are:

The obligation to be subject to existing laws, or such as may be established, regarding ownership, transmission, use and enjoyment of the property, and to submit to the decisions of the Mexican courts in everything that relates to it.

The duty to pay all taxes legitimately assessed on said property.

To contribute with his freedom and means toward the preservation of peace and order, in the place of his habitation, this not including the case of disturbances caused by political insurrections or civil war.

The status of a Mexican, which a foreigner assumes when he acquires real estate, shall not exist should he declare his wish to preserve his nationality.

SHIPBUILDING ON THE DELAWARE.

The iron and steel shipbuilding industry of the Delaware River has had a wonderful development since the opening of the present year, says the Philadelphia *Press*. The expansion of the trade has been without precedent. In this respect the Delaware River bears the same relation to the other shipbuilding centers as the jug to the handle. The proportionate amount of business done elsewhere in this country is insignificant. The business done during the first six months of 1883 is greater than the entire bulk of the transactions for 1882. The river is, indeed, the Clyde of America. The following table will show the tonnage of the iron and steel ships built in this country from 1868 to 1883:

Years.	No.	Tonnage.	Years.	No.	Tonnage.
1868.....	..	2,801	1876.....	25	21,246
1869.....	..	4,594	1877	7	5,927
1870.....	..	8,281	1878.....	32	26,960
1871.....	..	15,479	1879.....	24	22,008
1872.....	20	12,766	1880.....	31	27,582
1873.....	26	26,548	1881.....	42	28,356
1874.....	23	33,097	1882.....	43	40,097
1875.....	20	21,632			

During the last six months of 1882 there were building in New York, Philadelphia and Wilmington fourteen vessels having a displacement of 13,792.48 tons, and an approximate weight of iron in hulls of 10,000 tons. These figures were compiled by the Assistant United States Register of steam vessels, Mr. Titcomb. So far this year there have been builded at the various yards on the Delaware River fifty-one iron vessels, five of steel and thirty-six of wood. The total tonnage of the iron and steel vessels was 55,079 tons, or 110,158,000 pounds. The total weight of the iron and steel used in the construction of these vessels was 31,810 tons, or 63,620,689 pounds. There were also built thirty-six wooden vessels, having an aggregate tonnage of 20,426. If the production of the remainder of the year keeps pace with these, the total tonnage, estimating partly for present contracts, which are large and numerous, will not fall below 150,000 tons, with an actual weight, represented by steel and iron used in construction, of 180,000,000 pounds, or 90,000 tons.

ALGOL, THE DEMON STAR.

To the Editor of the Evening Telegram, Sept. 19:

Among the many interesting objects presented to our view in the evening skies of the close of the year, scarcely any are more interesting than the variable stars, so called on account of the periodic changes in their brilliancy. Our own sun is considered by astronomers as a variable star, with a period of about eleven years. This period is not only very long, but the difference in the amount of light given is too small to be appreciated by any but the most delicate photometric measurements. There are, however, about fifteen stars visible in northern latitudes, which are sufficiently variable to present a very marked difference at certain times from their ordinary appearance. Some of these at their minimum disappear entirely from view, while others can only be seen in the largest telescopes. The most singular and interesting of all these variable stars, both on account of the very short period of time in which its changes are accomplished and the remarkable alteration in its appearance, is a star which now rises early in the evening in the northeast in the constellation Perseus. To this star the Arabs, many hundred years ago, gave the name Algol, meaning The Demon, their fantastic belief being that the star was the slowly winking eye of one of these objects of their superstitious fear who inhabited that portion of the heavens.

Algol ordinarily presents the appearance of a star of the second magnitude, in which condition it remains for two days and fourteen hours. It then begins slowly to fade for about three hours and a quarter, when it sinks to the fourth magnitude. This appearance continues for about half an hour, when it begins to brighten, regaining its full lustre in about three hours and a quarter more. The time occupied in the round of change from one minimum to another is a little less than two days and twenty-one hours.

As many of these minima occur during the daytime, or at very inconvenient hours for observation, it is not often that Algol is observed at the interesting phase.

A favorable opportunity to watch the star will occur to-morrow, the 20th, when about three minutes past ten in the evening it will begin to fade, reaching its minimum of brightness at thirty-three minutes past one after midnight, at which time it will, to the eyes of many persons, be only just distinguished. A still more favorable opportunity occurs on the 23d, when it begins to fade at eight minutes to seven, reaches its minimum at twenty-two minutes past ten, and regains its full lustre at eighteen minutes to two a. m.

A list of all the dates at which the minimum of Algol may be observed for the rest of the year is here presented, together with the time at which the star passes the meridian, at which moment in the latitude of New York Algol is almost exactly overhead :

Date of minimum.		Star on meridian.
September 20	7:11 p. m.	2:38 a. m.
October 11	3:13 a. m.	1:39 a. m.
October 14	0:52 a. m.	1:28 a. m.
October 16	8:53 p. m.	1:20 a. m.
November 3	1:49 a. m.	0:13 a. m.
November 5	10:35 p. m.	midnight.
November 8	7:24 p. m.	11:49 p. m.
November 23	3:28 a. m.	10:50 p. m.
November 26	0:17 a. m.	10:38 p. m.
November 28	9:06 p. m.	10:30 p. m.
December 16	1:59 a. m.	9:19 p. m.
December 18	10:48 p. m.	9:11 p. m.
December 21	7:36 p. m.	9:00 p. m.

Three hours and thirty minutes subtracted from the time given for the minimum, gives the time at which the star begins to fade, which time, it is well to observe, will fall on the evening of the day before whenever the minimum is reached shortly after midnight. For instance, the waning phase of October 14, occurring four minutes past twelve A. M., begins on the 13th at thirty-four minutes past eight P. M. The same interval of time added gives the hour when the star will shine with its normal luster.

The observer must not forget that the star rises about four minutes earlier every evening, and, therefore, while it is now visible about two hours high in the northeast after dark, reaching the zenith or point overhead about three o'clock in the morning, it will at the end of the year be very high up when the sun sets, and reach the meridian about nine o'clock.

While Algol may be thus identified by noticing what bright star is exactly overhead at the hour given for the meridian passage, a better method of finding the star at the time when wanted is to draw an imaginary line from the little group of stars called the Pleiades, or Seven Sisters, to the constellation Cassiopeia, or the Lady in her Chair, which is well marked by five bright stars in the form of a W, and now visible in the northeast, very high up. Algol is situated on this line, about one-half of the distance from the Pleiades to the centre of the W. At about eight o'clock on the 21st of September, and for some time afterward, the three objects named, Cassiopeia, Algol and the Pleiades, are in a straight line from the zenith to the northeast horizon.

As to the cause of this singular and rapid variation in the amount of light emitted by the star, astronomers are not perfectly agreed, but the most generally received opinion, the theory that, on the whole, explains the phenomenon in the most satisfactory manner, is that Algol is attended by an enormous dark planet revolving at a very short distance from him in the period observed—that is, two days, twenty hours and forty-nine minutes—thus eclipsing a very large portion of the star's light—about seven-tenths. In order to give an idea o how matters stand, if this theory is correct, we will suppose Algol to be a sun of the same size and light giving power as our own—that is, 860,000 miles in diameter. The planet is then 720,000 miles in diameter and it revolves at a distance of about 5,000,000 miles from Algol. The planet is therefore over eight times the diameter of Jupiter, the largest in the solar system, and its distance from its primary is about one-seventh that Mercury is from the sun. Mercury being the nearest to the sun of any in the solar system.

However different this is from anything in the system of which our own sun is the center, both in the size of the planet and the enormous speed of its revolution in its orbit, it is not more wonderful than many things we know to exist among the stars, and it is the theory most generally accepted, as the character of the obscuration and the resumption of its brightness are precisely such as would be presented by the interposition of a dark body between us and the star, at intervals corresponding to the period observed.

It may not be amiss to remark that the list of Algol's minima may be extended by taking the exact hour of the observation of one, and then twenty days after another minimum will occur one hour and forty-two minutes later in the evening. If this should be inconveniently late, then take twenty-three days, instead of twenty, and one will occur one hour and twenty-nine minutes earlier than the hour of the one observed. This will appear on examination of the list given.

"ROYAL HILL."

CHICAGO'S WATER-SUPPLY.

While Chicago has still an abundance of water for the supply of all legitimate demands—a fact sufficiently proved by the simple statement that the consumption per capita exceeds that of any other city in the world—a material decrease in the pressure of the supply has been noticed during the summer. The warmest weather and the coldest weather test the capacity of the pumps, for in a period of extreme heat the demand increases for sprinkling and cooling purposes, and in extreme cold it is a common practice to let the water run in order to prevent it from freezing in the pipes. Under either of these conditions the daily consumption is apt to exceed 100,000,000 gallons, and the capacity of the two pumping-works (four pumps) is limited to 130,000,000 gallons. But this rate of consumption makes no allowance for stoppages, repairs, and rest which are necessary for all machinery. But, aside from these special conditions, the increase in population, houses, factories, and machines requiring water is drawing upon the service so largely that the force is seriously inadequate in those sections of the city at a considerable distance from either the north side or west side works. The time is rapidly approaching when the necessity for an enlargement of the water-supply will become urgent, and prudence suggests that preparations for better service should be delayed no longer.

It is agreed that the most expedient plan for increasing the water-supply is to construct high-pressure works for serving the district bounded by Twelfth street, the river, and the lake, which includes most of the elevators, machinery, and tall buildings. The capacity of the two tunnels is much greater than that of the existing pumps, and hence the water-supply may be increased enormously by the construction of the new pumps. At the time this matter was under discussion it was estimated by the City Engineer that all the additional facilities necessary for carrying out the high-pressure system for the districts described may be provided at a cost of less than $250,000. But the project was dismissed by the Council ostensibly on the ground that there was no money to provide for the pumps, but really because there was no money for the Aldermen in the scheme. We presume the same selfish and corrupt consideration will continue to stand in the way of the needed improvement. But it is worth while for the people who are the victims of Aldermanic intrigue to remember that, if the Mayor and Council had abided by the new license law enjoined by the State and nullified by the city, the revenue accruing therefrom would have provided four times as much as is necessary to furnish all the additional facilities requisite to an abundant and unfailing supply, and ample pressure of water even in the most remote parts of the city.

Chicago may be obliged to await the election of a more conscientious City Government before it can procure the high-pressure water-works which are needed; but in the meantime the present City Government has nothing to lose by instituting a more thorough system of inspection, to prevent the waste of water which is constantly going on in all parts of the city. If everybody were constrained to limit the consumption of water to a reasonable quantity compatible with the needs and comforts of metropolitan life, the pressure would be stronger everywhere, and there would be no legitimate ground of complaint in the immediate present. Perhaps Mayor Harrison may be induced, when he returns, to spare sufficient time from his political affairs to give this matter a little attention.—*Chicago Tribune.*

THE DRIVEN-WELL PATENT.

Nelson W. Green, a colonel of New York volunteers in the late war, to give the men of his command pure water, devised, in his own mind, a method by which this could be done. He first explained his idea to his drill squad, and afterward to the officers of his regiment, and it was this: To drive a rod sharpened at the end through the ground into the water-bearing stratum, and inserting in the bore a tube through which the water could be drawn by any ordinary style of pump. A test of this method was made successfully in 1861 on the plan of Green, and in the same year on the fair grounds at Cortland, N. Y., at the expense of one Graham, who had a contract to supply food and other necessary articles to the soldiers encamped there. This well was used generally by the men in camp, and by Graham and his employés. In 1868 Green procured a patent for this invention, and in 1871 had a reissue thereof, in which he claimed as his invention the creation of a vacuum in the lining of the well for the purpose of using the pressure of the atmosphere to bring up the water. In a suit—Andrews vs. Hovey—brought in the United States Circuit Court for the Northern District of Iowa, for an injunction and damages for the infringement of his patent, the defendant first denied that Green was the inventor of the driven well; second, averred that if he was the inventor, he had abandoned his right to a patent by allowing a public use of the invention for more than two years before the granting of the patent, and, third, that the claim under the reissue was broader than in the first patent. On the trial the foregoing facts were shown, and it was also proved that this method of driving wells was used at Milwaukee, Wis., in 1849, and at Independence, Mo., in 1851, and it was also shown that the original inventor did not claim the creation of the vacuum and the effect of the atmospheric pressure. Judge Shiras, in dismissing the bill, said:

1. Whatever may be the intention of the inventor, if he suffers the invention to go into public use through any means whatever, without an immediate assertion of his right, he is not entitled to a patent, nor will a patent then obtained protect his right.

2. It is shown that in 1851, at Independence, Mo., a tube was driven into the water-bearing stratum, and, by a pump attached to the tube, water was drawn through it in an apparently inexhaustible quantity. This might be treated as a mere isolated experiment, which would not be held to defeat the right of an independent inventor. But in 1849 and 1850 E. W. Purdy, a witness in this case, as he testifies was a well-maker in Milwaukee, Wis., and he used iron rods about 2 inches in diameter and coupled together. The first rod was 16 feet long, with its lower ends made for a drill, and it was worked in the earth by being run over a gin-pole, and so the earth was displaced. The 4-inch tubing was driven into the opening as the boring progressed. No soil was removed from the ground, except that where quicksands were struck a long sheet-iron bucket, with a valve at the bottom, was employed to bring up the quicksand. When the water was reached, if it did not come to the surface, a pump was attached to the tubing which formed the lining of the well. Purdy testifies that he drove a number of these wells, some of them to the depth of 60 and 100 feet. We must confess that we cannot see any substantial difference between these wells and those by the Green method.

3. It is urged that the great merit of Col. Green's invention consists in the discovery of the effect of the vacuum created. According to the view we take of the original patent, it did not cover or describe the application of this principle. It follows, therefore, that the reissue embraces the application of an important and material principle not found in the original. The rule is well settled that a reissue can be validly granted only for the same invention which was originally patented. If the reissue goes beyond this, and covers other and different inventions or improvements suggested by the use of the original invention, it will be void.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 435.)

DLXIV.—AUGUSTA, ME.

Augusta, Maine, in lat. 44° 19′ N., long. 69° 50′ W., on the Kennebec River, at the head of tidal navigation, is on ground rising from the river to a considerable elevation. The river is dammed, furnishing a valuable water-power.

Water-works were built in 1873 by a private company, taking the supply by gravity from an impounding reservoir holding 3,000,000 gallons, built on a small stream fed by springs. The elevation is sufficient to give 65 lbs. pressure in the lower part of the city. Distribution is by 2 miles of Wyckoff wooden pipe, of from 8 to 4 inch diameter. There are 8 fire hydrants, for which the city pays $25 per year each.

The population in 1880 was 8,665.

No information can be obtained regarding the number of taps or the daily consumption.

The works cost $30,000. G. C. Vose is Treasurer of the company.

DLXV.—ATTICA, IND.

Attica, Indiana, in lat. 40° N., long. 87° W., is on the Wabash River.

Water-works were built by the city in 1875, taking the supply from springs, the water of which is collected in a reservoir and is pumped 300 ft. by a Dean Brothers steam pump to a distributing reservoir. Distribution is by 2 miles of cast-iron pipe of from 10 to 4 in. diameter, with 7 fire-hydrants, 10 gates and 175 taps. The population in 1880 was 2,150 and the daily consumption in 1882 was 100,000 gallons. The works cost $35,000. The expenses of maintenance in 1882 were $1,200 and the receipts $1,000. The works are managed by a committee, of which Samuel Clark is chairman.

BRIDGE CONTRACTS LET.—The construction of the Little Saskatchewan bridge has been let to Mr. J. F. Sargent, at $18 per foot; the Willow Creek bridge to Mr. Taylor at $2.75 per foot, and the Elton Creek bridge to Mr. White at $7.97 per foot,

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.
Tribune Building, New York City.

The Engineering News Publishing Company, Proprietor.

Published Every Saturday.

CONDUCTED BY
GEO. H. FROST and D. McN. STAUFFER.

TERMS OF SUBSCRIPTION:
$4.00.....PER YEAR TO U. S. AND CANADA.
$5.00..... " " " FOREIGN COUNTRIES.
Make all drafts and cheques payable to ENGINEERING NEW PUBLISHING CO. Postal Money Orders, for convenience, may be made payable to GEO. H. FROST.

Engineers of standing are paid fully as much in England as here as a general rule, and are better remunerated even in official positions. The Water Engineer of Glasgow is not only paid a salary of £1,000 annually, but has permission to advise the Water Commissioners of the towns. The salary of the Water Engineer of Dundee was lately raised to £500.

THE DRAINAGE OF THE VALLEY OF MEXICO.

The Boston *Herald* of Sept. 17 contains a letter from its Mexican correspondent upon this subject, the text evidently derived from a personal interview with Mr. Francisco de Garay, the celebrated Mexican civil engineer. The entire subject is treated at full length in a paper read by Mr. de Garay before the Amer. Soc. C. E., and published with maps and plans in the May (1883) transactions of that society. A full abstract of Mr. de Garay's paper appeared in ENGINEERING NEWS of July 17, 1883.

A NEW ELECTRIC MOTOR.

The last number of *Harper's Weekly* contains an illustrated description of a new electric motor, the property of the Daft Electric Light Company, of Greenville, N. J. At the company's works a track one-quarter of a mile long has been constructed and upon this the motor is now being run and tested, the first public exhibition having been given last week.

The rails are apparently the conveyors of the electric current, being connected by copper wires, although it is claimed that the track is built as in ordinary practice and with the ordinary material, without any attempt at insulation.

The description is technically very incomplete, but some idea of the amount of electric power consumed in the experiment can be arrived at by the statement that a 450 pound motor ascended an incline representing a grade of 2,000 ft. per mile, by the attraction force of the electric current passing from the rails into the driving wheels. This same motor exerted a tractive force of "300 pounds" on a level track and "will move with ease seven or eight tons on an ordinary track."

Like the majority of "the new motors now under trial" no statement of the cost in dollars is given to accompany this experimental report. As Edison lately remarked, an ordinary boiler might be charged with champagne and fired with London Dock brandy, but the resulting power would hardly compare favorably in cost with the like results obtained from very ordinary coal.

THE WATER SUPPLY OF THE CITY OF YONKERS, N. Y.

The last report of the Water Commissioners of the City of Yonkers, N. Y., has been received, from it we make the following abstract: The total distribution laid consists of 24½ miles of pipe of all sizes, and 263 hydrants; the least average daily consumption of water during the year occurred in February, and amounted to 800,000 gallons, the greatest daily consumption was in August, and amounted to 1,375,000 gallons; the average daily consumption throughout the year was 1,338,000 gallons. The distributing reservoir, with a total capacity of 1,700,000 gallons, is evidently insufficient, and the attention of the authorities is called to this fact. The cost of pumping the water was $15.07 per million gallons. The surplus earnings over expenses were $21,301.49, which is $4,752.14 in excess of last year's revenue. The expense of maintenance and operation was $12,099.95. There are two pumping engines—a Wright engine, built at Newburgh, N. Y., and a 3½ million gallon Worthington pump lately erected. The latter has just been tested, with the following results, a duty of 70,000,000 gallons having been guaranteed: the test lasted 24 hours; water pumped, 3,681,520 gallons, measured by plunger displacement; total lift, 238.978 feet; feed-water heated to 42° F.; coal consumed (Old Company's Lehigh) 10,253 pounds; engine made 85,221 strokes in the 24 hours, each averaging in length 3.1667 ft. in length; superficial area of plunger, deducting pump rods, was 1.8422 square feet. Deducting one per cent., the duty found was 71,564,013 foot-pounds for each 100 pounds of coal consumed.

The Chief Engineer, Mr. W. W. Wilson, at the request of the Board, prepared plans, and furnished estimates for a proposed high service. Three plans have been submitted, viz.: 1. By direct supply from pumping machinery. 2. By reservoirs, supplied by pumping from Lake Avenue. 3. By a water tower, supplied by pumping from same source. The third plan was considered the best from every point of view. The Legislature has authorized the issue of $75,000 in bonds for this purpose, and it is expected that the work will be started as early as the season will permit, and the work finished during the current year.

JOHN C. TRAUTWINE, C. E.

It is with more than usual sorrow that we note the death of this widely-known civil engineer; and thousands will, with us, feel keenly the loss of one of the most useful men known to the profession.

No eulogistic pen can ever do full justice to his memory; but his monument already exists in the grateful remembrance of the profession he loved so well, for the good work he has already done.

While Mr. Trautwine was perhaps better and more widely known than any other individual American engineer, through his several published works, it was necessary to know him personally to fully appreciate the worth of the man. All knew the engineer, but comparatively few had the pleasure and profit of his personal acquaintance.

In his chief characteristics he was unbending in his honesty of purpose, straightforward, frank of speech, cordial in manner, and extremely modest and careless of mere personal fame. His perseverance and energy were almost phenomenal; he labored in his chosen profession purely for the love he bore it, and for the greatest good to the greatest number. Distance, labor, or advancing years were never allowed to interfere when a new result was to be obtained, or some advance in his profession to be investigated and recorded.

Of his industry in the collection of useful data, the engineers of the world have sufficient proof in the wonderful gathering together of facts and tabular matter in his popular "*Pocket Book*." For fifty years and more his note-book was an inseparable companion, and whenever and wherever he encountered anything of interest to his profession a record was made, measurements taken and effects noted. In this, as in all his work, he was conscientious and painstaking; he made notes to use them, and did not mean that the slightest feature should escape him that might prove in the future a useful factor. To his thirst for knowledge he even sacrificed his right arm, having lost that member in obtaining the exact dimensions of the first iron coal-car that he had observed.

His fund of information was as exhaustless as the field of his research was wide; and his practice and experience extended over a period of fifty-five years, a period covering all that there is in the history of American engineering. As a young assistant to Mr. Strickland he did duty upon the Pennsylvania State Railroad, the parent of the most powerful railroad system in the country. The first section of T-rail sent to America by George Stephenson was put under Mr. Trautwine's especial care, and he related how, before exhibiting it, he was directed to have the ends of the rail carefully boxed so that no one could obtain a "section" of this innovation and improvement on the cast-iron "fish-belly" rail of the day. He and his long-time friend and fellow engineer, Ellwood Morris, made a Sunday excursion to see the wonderful switch just put down on the Newcastle and Frenchtown Railroad, that was destined to supplant the turn-table, or the cast-iron pivot switch then in use to transfer cars from one track to another. He made, from personal examination accurate and most exquisite drawings of the bridges of his early days, wooden structures, timid in their spans, very uncertain in their proportions; and lived to see, at least in print, the boldest works of modern engineering executed in the country of his birth, and by men who were but children when he was in the full practice of his profession.

To the younger members of the profession of civil engineering, and to those especially who had the honor and profit of a personal acquaintance, his memory will always be a grateful one. His kindly words of encouragement, his timely hints on their tentative works, which he was always fond of visiting, even his good-natured scolding, have been productive of much good, and will be remembered in years to come by many as the spurs that impelled them to more ambitious works and to success. He was patient with their faults, but unsparing in his criticism; and his advice was so kindly given withal that profit always followed.

With Mr. Trautwine no thought of self or self-interest ever interfered with duty; his expressions of opinion were fearless and always conveyed his honest convictions. He was honest, with all that term conveys. He would have nothing to do with the man who allowed his personal feelings or prospective gain to warp his professional judgment, and would only act when his sole guide was his own experience and his clear conscience. He was a noble representative of a school of sturdy engineers, now fast passing away; men who said what they meant, and were possessed of a conscience that is now unhappily not always fashionable or profitable.

MEETING OF THE AQUEDUCT BOARD.

The Board met Sept. 11, to hear persons interested in the proposed plan of building a dam at Quaker Bridge. Matthew Richardson proposed a plan to use the Harlem River as a reservoir by damming the two ends; his plan was not considered. Orlando B. Potter objected to the Quaker dam project on the score of public health, as the water would be drawn down 58 ft. every year; he advocated the building of a dam at Brewsters, at a cost of $1,200,000.

The commission next listened to a report from the Department of Public Works, presented by Commissioner Thompson, giving additional plans for the increase of the water supply, with special reference to a plan worked out by Chief Engineer Church, to build a subsidiary dam at Muscoot Mountain, in order to overcome any sanitary objections which might be raised to the building of the Quaker Bridge dam. The first point made by Mr. Church was that by his plan water can be brought to the city through the new aqueduct, as soon as the latter can be completed. The mouth of the new aqueduct, the engineer suggests, should enter just above the Croton dam, 60 ft. below the surface at high-water mark, instead of at the Quaker Bridge Dam. Its mouth will be near the bottom of the present Croton Lake. It can be fed by two short branches, or by passes, tunneled through the rock, of the size and shape of the new aqueduct. One by-pass should enter above the Croton dam and one should run around the dam to a point below. The upper by-pass would draw water from the above dam, and the other would be utilized after the completion of the Quaker Bridge dam. The upper by-pass communication with the lake can be used as soon as the new aqueduct is completed, and the city thus be furnished from the lake

as it now is, with an additional supply sufficient to bridge over the interval before the completion of the large storage reservoirs. This will at once relieve the old aqueduct from its over-head, or allow of its being entirely emptied and put in thorough repair.

Mr. Church's second claim for his plan was that it will insure circulation throughout the entire body of water contained in the great reservoir The gate-house in the by-pass connecting the new aqueduct with the Croton dam reservoir or lake, Mr. Church thought, should have three sets of gates to regulate the admission of water into the center bay, or chamber, of the gate-house. Of these three sets of gates, one will draw water from the bottom of Croton Lake, and can be at once utilized ready to carry it. The second set will communicate with the great reservoir by the tunneled by-pass or lower branch around the Croton dam to a point below. By this means can be drawn the water stored between the Croton and Quaker Bridge dams, and this lower mouth of the new aqueduct, entering from below Croton dam, will draw upon the total storage in precisely the same degree that it would if entered at the Quaker Bridge. The third set of gates will draw water into the aqueduct from near the surface of the great reservoir. When the Quaker Bridge dam is completed this arrangement of gates will enable water to be drawn from uear the surface in flood times, when the water will be cleaner and better, and from the bottom in hot, dry weather, when the surface may be less pure, because of vegetable scum. The better to insure circulation in the deep waters in the vicinity of Quaker Bridge dam, Mr. Church proposes to construct a gate-house communicating with the old aqueduct at that point similar to the one suggested for the entrance to the new aqueduct at the Croton dam.

The next point made by the engineer was that by his plan such storage will be gained as will provide an immediate additional supply of 30,000,000 gallons of water a day. The entrance of the new aqueduct into Croton Lake just below the Croton dam, 60 ft. below the surface of the great reservoir when the latter is full, will, Mr. Church said, bring it 26 ft. below the lip of the Croton dam as it now is, or near the bottom of the present lake. The lake will thus be converted from a mere settling basin to a storage reservoir. Mr. Church proposes to construct a small masonry dam at Muscoot Mountain, near the upper end of the present Croton Lake, and about six miles from the present Croton dam. This dam is to be not more than 29 or 30 ft. high, and can be completed and filled by the time the new aqueduct is finished. Its estimated cost is about $400,000. Two important purposes will be subserved by the Muscoot dam. Its effect upon the water supply will be in forming a lake which will give 2,500,000,000 gallons of storage, which, in conjunction with the present Croton Lake, will be sufficient to supply the new aqueduct with water enough to bridge over the interval, even if a longer time is required to complete the Quaker Bridge dam than is now anticipated. The Bronx River water supply, Mr. Church remarked, will be obtained within two years, insuring a total increase to the city by the time the new aqueduct is completed of over 140,000,000 gallons per day. The second and most important work of the Muscoot dam will be the sanitary protection it will exert over the region above the dam. On this point Mr. Church laid much stress. During dry seasons it will become necessary to draw down the large reservoir from 20 to 60 ft. This will lay bare many acres of land at the up-river end of the reservoir in the most thickly settled region, at the villages of Katonah, Golden Bridge and Purdy's Station. The malarial effects thereby produced in these places should be used with telling force against the big reservoir plan. By the simple means of erecting the small dam at Muscoot Mountain, Mr. Church asserted, this whole difficulty is overcome. When the large reservoir is drawn down the upper shoals at Katonah, Golden Bridge and Purdy's Station will still remain covered, and the proper hygienic conditions will be preserved. The sheet of water above the dam will rarely, if ever, be disturbed. Through all the shoal places above Muscoot Mountain streams pass, which would keep up circulation and prevent the water from remaining stationary or becoming stale. In time of droughts the Croton dam will act precisely as the Muscoot dam in protecting the hygienic conditions. Thus the three dams will form three separate steps for draining down the storage without uncovering the shoals. Mr. Church remarked that the starting of the new aqueduct at Croton dam alters the objective and salient points as regards the location of the aqueduct line between Croton River and a point on the line already presented to the commission just below Hastings. The Sawmill River Valley route, he says, will be more direct, and, for some reasons more advantageous, although it may require more shafts and will be from one-fourth to three-fourths of a mile longer. It will avoid passing down the extensive Hudson River slope, through its villa sites, country residences, etc. The next point discussed by the Chief Engineer was the protection of the shores of the great lake from wave action, which soils the water, and also the prevention of vegetation. The wave action of so large a body of water must be great, and it is important to beach the shores with gravel or sand, or both.

The last point discussed by Mr. Church was the best means of introducing water by the new aqueduct into the Central Park reservoir. The present plan is objectionable, because when the aqueduct is shut off for repairs or inspection the water is drawn out of the reservoir during the interim, and a serious loss of pressure continues to be felt in city pipes until the reservoir is refilled, which takes, sometimes, weeks and months. This can be avoided by so arranging the conduit and gate-house from which the city pipes are fed that water can be conveyed directly into the outlet gate-house chambers or bays. The full discharge of the aqueduct contents would at once fill the chambers, and so give to the city pipes full head, instead of waiting for the reservoir slowly to refill. In the great lake on the Croton River ample settlement will take place for the water to become sufficiently clear to deliver it directly into the city circulation.

Dr. Harris and Mr. Brooks studied Mr. Church's plan carefully, and both expressed themselves as especially pleased with the idea of building of Muscoot Mountain dam, as the lake thus formed would, they said, do away with the objection that malaria might be spread from the shallow flats at the upper end of the big reservoir.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
SEPT. 19, 1883.

The Society met at 8 p. m., Vice-President Wm. H. Paine in the chair, John Bogart, Secretary.

A discussion by Mr. Charles Douglas Fox of London, corresponding member of the society, "On the Increased Efficiency of Railways" was read by the Secretary.

Mr. Fox referred to the fact that English railway managers and engineers have long realized the great importance and economy of a thoroughly substantial road-bed. The formation widths of their chief railways are now made 30 feet, both in cuttings and on embankments for the double lines, and very great care is taken to thoroughly drain this formation in cuttings by deep ditches on each side, with earthenware drain pipes in them, and fill in with broken stone or other dry material. The ballast, consisting of broken stone, clean gravel, coarse sand, burnt clay or ashes, is not allowed to be less than one foot in thickness below the bottom of the tie. For lines of constant and heavy traffic, the bull head grade, double headed rail, having a large top member for wear, and a very small bottom member, is found to be the best section for steel rails. The weight of these rails is 84 pounds per yard. The chairs are from 40 to 46 pounds each and the rails are secured in them by keys of compressed oak. The tendency of the English companies is to expedite traffic, both passengers and goods, not by higher rates of speed, but by reducing the number of stoppages. The traffic lines are gradually quadruplicating their tracks, in some cases throughout—in others by siding several miles in length. There is a very general feeling in England in favor of identifying the driver with his engine, and holding him responsible for its working. On some lines the name of the driver is conspicuously attached to the engine. Mr. Fox forwarded also the railway regulations of the English Board of Trade, which give very minute directions in reference to the constructions and running of railways.

A paper by Mr. Wm. Howard White, M. Am. Soc. C. E. was also read upon the subject of "Railroad Bridge Floors." Mr. White advocates inside guard rails for the purpose of preventing, as far as possible, serious results from the derailment of wheels.

His reasons for advocating the inside guard rail are, that he considers them more efficient for the same height above the tie than the outside guards; that they can be placed so as to hold the wheel nearer the rail, particularly when the use of the snow plow is considered; that they can be more strongly secured at the ends for the purpose of drawing derailed wheels toward the rail, or to secure the ditching of a car which has gone too far to be safely drawn back; that they are more economical.

He considers that the ties should have five inches of clear distance between them.

The papers were discussed by Messrs. Wm. H. Paine, Cooper, Blunden and Bogart.

THE "TREMONT" METER.

The adoption of this, until very recently, unheard of machine by the Boston Water Board has been the occasion of much discussion by the Boston daily press, and a subject of interest generally to manufacturers and users of meters.

From the official report made to the Board, by Hiram Cutts, Superintendent of the meter division, we obtain the following description of this particular meter:

"The Tremont is a single cylinder and double piston, one piston working in the other with main and auxiliary valves. These valves are attached to the inner piston, and, as an inside guide, and control the whole movement. Totally different in application from any other machine, this receives the water in the center of the cylinder, and by means of a port in the piston, which is constantly in contact with the inlet, passes to inside of first piston and acts on the inner one, and by means of valves the two are operated in connection; ports in the end of first piston conduct the water to the force-chambers alternately as governed by the action of the inner piston. In the performance of its duties there are no indications of exertion or hard labor, but, on the contrary, it accomplishes its work with perfect ease.

"When in full operation its action is like the natural breathing of a heavy person.

"It is composed of four working parts, viz., outer and inner piston and inner valves. Material good, and workmanship of the best order; altogether a very superior machine. Weight, 26 pounds, occupying a space of 6½×7½ inches. Retardation, 21 pounds, discharging 1,600 gallons per hour."

We give the above descriptions as in the report, trusting that meter experts will understand just how the thing works; we must confess that we don't.

The board in its report refers to this meter as one of the "oldest patented meters." In reference to this statement, and as of interest in the history of this triumphant meter, we have obtained the date of its patent and the record of its successive transfers of ownership.

This meter was patented by Thos. Sweeney, March 22, 1870, and he at once assigned one-half interest to Mead & Addy; April 4, 1870, Thos. Sweeney, Albert G. Mead and Chas. J. Addy each assigned a one-third right to Henry C. Mahurin; May 27, 1871, Mahurin assigned to Benj. F. Nourse one-third of his individual interest, and on June 22, 1872, he transfers his remaining two-thirds to the same party. Feb. 13, 1873, Thos. Sweeney assigned to Nourse one-half his interest, and on Feb. 14, 1873, Mead & Addy each assigned to the same Nourse one-half of their interest; on Feb. 21, 1880,

both Mead and Addy transferred to Benjamin F. Nourse all their remaining interest in the patent.

Feb. 24, 1880, B. F. Nourse assigned to Fred. Curtis, Solicitor of Patents, a one-tenth interest; March 8,1880, Ellen Sweeney, her husband being dead, transferred to B. F. Nourse all of her interest, and on June 1, 1880, B. F. Nourse assigned to F. A. Osborn, W. V. Hutchings, F. Curtis, B. F. Nourse and E. D. Hayden all right to the meter patent, and these parties organized under the name of the "Sweeney Water Meter Association," May 21, 1883, F. A. Osborn assigned his right to Curtis & Nourse; and June 8, 1883, Fred. Curtis assigned his right to the "*Tremont Meter Co.* of *Maine*;" Ellen Sweeney confirmed this assignment Aug. 20, 1883, just four days after the contract had been made between the "Tremont Co." and the city of Boston.

In the corporation tests made of standard meters the following patterns were used: Worthington, Ball & Fitz, or Worthington improved, Equitable, Standard, Boston, Tremont, Balance Valve, Continental, Crown, Undine, and Spooner Diaphragm, eleven in all.

The tests were made "strictly in accordance with the instructions, as laid down to me in the communications from the Boston Water Board, under date of July 5." These instructions required Mr. Cutts to examine and test the several meters with "reference to accurate measurement of water, simplicity of mechanism, liability to obstruction, compactness, weight, durability, material, general excellence and price;" and "that no meter shall be accepted for testing, unless known in the market as standard instruments, or represented by corporations or individuals who are prepared to give to the board a satisfactory guaranty of their ability to furnish all the meters required, and when furnished they shall be up to the tests."

The tests were commenced July 19, and continued until August 10—just *twenty-three days*—when the decision was announced. The tests for accuracy were made by *four* different runs of ten cubic feet each; the first by a ¾ in. delivery, the second by a run of ⅝ in., then by a ½ in. and ⅛ in. run; the pressure was 48 pounds to the square inch. Mr. Cutts reports that "no meter was confined to a single run, but was in some cases tested two, three, and four times, in order that the results might be unquestionable accurate and satisfactory."

The meters were then placed side by side and applied to their full capacity, with a ¾ in. supply and a ¾ in. delivery, under a pressure of 51 lbs. per square inch; this test was continued 14 days or 336 consecutive hours.

The meters were tested for accuracy of measurement, sensibility and friction, endurance and wear and tear, both before and after the 14 days run.

The conclusions arrived at are well known, viz., "the Tremont meter is in advance of all others, for accurate measurement of water, etc."

Mr. Cutts also call the attention of the board to the fact that "at the present time there are in the service of the city various styles of meters, and as many more different patterns in the market, all being urged for adoption by this department.

"The meters already in the service have been doing duty a long time, and need more or less repairs; others will soon demand similar attention. This continual removal and substitution, especially where there are meters of various styles and patterns in use, causes unnecessary annoyance and expense in making the connections.

"The remedy for this is the adoption of one uniform style of meter and connections, the connection to be of regulation sizes and thread. I trust the committee will give this suggestion especial consideration."

We have given the history of this late meter test as above. The results as obtained by Mr. Cutts we will not publish until they have been verified by more than a fourteen or even a twenty-three days' test, and have been tried "in some cases" more than once.

We leave each one to draw his own conclusions, and will only remark that, in our opinion, there has been undue haste in the *testing*, *adoption* and *purchase* of the "Tremont" meter.

The weak point in Mr. Cutts' otherwise most favorable report is found in the closing paragraphs, which we have quoted. One thousand five hundred meters are now in use in Boston, of "various styles," and have been "in use for a long time." What is it that has so suddenly enlightened the board as to the utter worthlessness of all the long-tried patterns? They seem to have been doing their duty all these years, and have given satisfaction to all concerned.

As the board has formally adopted a special meter under conditions and circumstances that, to say the least, look suspicious, it should be careful how it suddenly supplants the many now in use by "a uniform style of meter," as especially recommended to it by the superintendent, who is so ready to act "strictly in accordance with instructions."

The contract between the "Tremont Meter Co." and the city of Boston was made Aug. 16, 1883. By Sept. 6, 1883, the date of its report, the board had already expended $84,155.50 of the $50,000 appropriation. Surely, the report made to it by Mr. Cutts on *Aug.* 15, 1883, *one day* before the signing of the contract with the meter company, must have had a most convincing effect upon the board. It does look as if they were pretty well assured, before that report came in, which meter would be successful in the competitive examination. It usually takes more than twenty-four hours to arrange the business details of a transaction involving the expenditure of $50,000 of public money.

WATER METERS.

A reporter of the *Traveller* has interviewed Mr. William A. Simmons, chairman of the Water Board of this city, with the laudable intention of finding out if any public test was to be made of the water meters before the fifty thousand dollars appropriated by the city is expended. His reply is this:

"The appropriation made was $50,000. We have ordered $35,000 worth of meters. It will require from $10,000 to $15,000 to box and attach them. Therefore, the matter, so far as this board is concerned, is concluded. If any one desires to make further tests he can purchase meters of the Tremont pattern and test them all he pleases."

This reminds us of the position taken by Tweed when any complaint was made to him of extravagance: "What do you propose to do about it?" Mr. Simmons virtually snaps his fingers in the faces of the tax-payers and tells them to go and expend a few hundred dollars and make the tests themselves. He forgets that he is the servant of the public and that he is not the autocrat that his language would incline us to believe that he thinks he is. When he says the public can purchase the meter adopted, he ought also to tell the public where they are for sale. We will gladly give the company a free advertisement, provided the place is named within a reasonable time. The stock of the Tremont Meter Company can be much more easily secured at $21 per share. In the first place there is no such meter patented as the Tremont meter. It is the Sweeny Meter, and this patent was assigned to the Tremont Meter Company, a corporation formed under the laws of Maine, June 8, 1883. The tests made by Mr. Cutts were completed August 10. In the special report of the Water Board the meter is styled "the oldest patented meter," but Mr. Cutts, in his report of the tests, speaking of meters, says that "in the last few years great strides have been made." There is a slight discrepancy here for while this meter is not, "the oldest patented meter," as claimed by the Water Board, it is sufficiently old not to be placed in the category assigned it by Mr. Cutts, who adds that "a perfect meter is not yet and perhaps may never be reached."

As we have stated previously, we make no war upon the Sweeny meter. It may be, for ought we know, the best meter. We claim that indecent haste has been made in expending fifty thousand dollars of the people's money, and we claim that the only honest and fair way to reach a result was by a public test under the superintendence of scientific men and competent mechanics. We should gladly have had Mr. Cutts a member of this examining board. Mr. Simmons, in his interview, states that the test was made in private because the "parties interested in meters under test have (heretofore) succeeded in bribing the officials of the City Government."

This is a very grave charge. Why not name the owners of meters who have been guilty of such a dishonorable transaction? Until the charges are more specifically made it will not divert public attention from the hasty manner in which the meter question has been disposed of at the expense of the tax-payers, or the offensive manner in which Mr. Simmons arrogates to himself the power of reaching a just conclusion regarding meters upon tests of only fourteen days' duration. Scientific experts would require at least six months to reach a just verdict. The transaction is simply indicative of the loose manner in which an important public matter is treated. Mr. Simmons, in his interview, is pleased to say "that as much efficient work has been done by the present board since its advent to office as has been done anywhere in any public department in a like space of time." This praise would have had weight if it had come from some disinterested party, but it sounds strangely enough coming from an official who imagines that in a few short months he has mastered a system which has taxed the brains of men of far greater ability than he, who modestly admit, after years of practical attention to the subject, that they have yet much to learn. Mr. Simmons is a mere novice in such matters, and has a deal of information to acquire before he can be accepted as an expert on water meters. His flippant allusions to his predecessors and his personal brag will not cover up the fact that fifty thousand dollars will be expended before there has been a test sufficiently open and decisive to satisfy the tax-paying public.—*Boston Journal.*

PERSONAL.

SILAS SEYMOUR was renominated for State Engineer and Surveyor by the Republican Convention held at Richfield Springs this week.

SUPERVISING ARCHITECT HILL has tendered his resignation to Secretary FOLGER to take effect as soon as his successor qualifies. He gives no reasons for his resignation in his letter to the Secretary.

C. P. HUNTINGTON, the railroad magnate, was a poor boy and a hard-working young man. He did not begin to accumulate his immense fortune until he was past forty, when he staked all his savings on the scheme of the Pacific Railroad.

OBITUARY.

JOHN CRESSON TRAUTWINE was born in Philadelphia, Pa., March 30, 1810. Having shown an early and decided taste for the natural sciences, he attended the Franklin Institute High School of that day, and under Walter R. Johnston, teacher of chemistry, and James P. Espy, the originator of our present signal service, who taught mathematics, he soon acquired proficiency in those branches to which he was naturally so much inclined.

In 1828 he entered, as a student, the office of William Strickland, the leading architect and engineer of his time in that section. Ellwood Morris, well known as an engineer and author, and Thomas U. Walter, afterward architect of the new Capitol building at Washington, were his fellow students. These young men, in the course of their studies, personally visited, measured and then made careful drawings of all the important engineering and architectural works in their neighborhood, and Mr. Trautwine's drawings, still preserved, are models of careful work and artistic coloring. While with Mr. Strickland he assisted in the erection of the United States Mint and the Blockley Almshouse, in Philadelphia, and also, we believe, in the building of the United States Bank, now the Custom House.

Probably his first contribution to engineering literature was an illustrated description of the old wooden Burr truss bridge spanning the Schuylkill River at Peter's Island and still in use by the Philadelphia & Reading Railroad. This appeared in the *Franklin Institute Journal* of August, 1834.

As a measure of his rapid advancement in the profession of architecture, we might mention that in the first years of his tutelage under Mr. Strickland, and when only 18 years of age, he made a competitive design for the Penn Township Bank, at Sixth and Vine streets, Philadelphia, and obtained the prize, the bank being erected from his plans and under his superintendence.

In 1829 he and Morris were sent to the Delaware Breakwater as assistants, and remained there during the first working season. In 1831 Mr. Trautwine became Assistant Engineer on the Philadel-

phia & Columbia Railroad and assisted in running the line from Columbia Bridge to the station on Broad street. In 1833, with J. Edgar Thompson, long time President of the Pennsylvania Railroad, he made a survey for a canal to run from Fairmount through West Philadelphia to the mouth of Mill Creek, near Gray's Ferry.

In 1835 Mr. Strickland, then Chief Engineer of the Wilmington & Havre de Grace R. R. (now part of the Phila., W. & B. R. R.) made Mr. Trautwine his Prin. Asst. Eng.; it was while engaged upon this work that he first met the late Benj. H. Latrobe, of Baltimore.

In 1836 Mr. Trautwine succeeded Saml. Kneass as Engineer of the Phila. & Trenton R. R., but resigned in a few weeks to accept the position of Chief Engineer of the Hiawassee, now East Tenn. & Geo. R. R. Construction began in Jan., 1837, and the subject of our memoir remained in connection with this road until 1842, when financial difficulties caused suspension of work. In 1838 he was married to Miss Eliza Ritter, daughter of Jacob Ritter, Esq., of Phila. A short time before the collapse of the Hiawassee R. R., the Chief Engineer and Gen. Jacobs, of Pittsburg, the president of the road, made a study and examination of the manufacture of iron, with the intention of erecting works on the line of the road for the rolling of their own rails. They were on the point of building works to roll the first rail to be made in the United States when the suspension occurred.

In 1844 Mr. Trautwine made a survey for the Ralston & Blossburg Railroad, in Pennsylvania, and shortly after left the United States for Carthagena, South America, as assistant to Gen. Geo. M. Totten, in the construction of the Canal del Dique, which was to connect the Magdalena River with the Caribbean Sea. He remained on this work until 1849, when he returned to Philadelphia, and soon after made a general survey of the borough of Germantown, now incorporated with Philadelphia. Most of the streets of that part of the city owe their location and names to him.

In January, 1850, Mr. Trautwine made the final survey for the line of the Panama Railroad, and remained in connection with this work until December of the same year. Mr. Trautwine had been induced by the Aspinwalls of New York to undertake the building of this road, with an estimate of cost based on previous surveys. Upon arriving at the Isthmus he found this data at fault in every particular, and upon declining to proceed under the original contract, he was made the Chief Engineer, and proceeded to make a resurvey.

The first edition of his "Field Practice of laying out Circular Curves for Railroads," and "A New Method of Calculating the Cubic Contents of Excavations and Embankments," appeared in 1851.

It is claimed for Mr. Trautwine, that he was the originator of the "trussed suspension bridge;" and in this connection he remarks in his "Pocket Book" as follows: "The writer believes himself to have been the first person to suggest the addition of very deep trusses braced together transversely, for large suspension bridges. Early in 1851 he designed such a bridge with 4 spans of 1,000 ft. each, and 2 of 500 ft., with wire cables, and trusses 20 ft. high. It was intended for crossing the Delaware River at Market St., Philadelphia. It was publicly exhibited at the Franklin Institute and the Merchants' Exchange, and was finally stolen from the hall of the latter. Mr. Roebling's Niagara Bridge of 800 ft. span, with trusses 18 ft. high, was not commenced until the latter part of 1852, or about 18 months after mine had been publicly exhibited."

In 1852 Mr. Trautwine was again sent to the Isthmus by some New York capitalists to ascertain the practicability of a scheme for constructing a canal route, for steamers of about six feet draft, from ocean to ocean, via the rivers Atrato and San Juan, in New Granada. He made this survey in four months, assisted only by one white man and the Indian natives. He ascended the Atrato nearly to its source, made soundings and obtained width and general course, and examined various passes through the Western Cordilleras. The route recommended by him as theoretically the best was to ascend the Atrato 80 miles to Vigia Cubarador, and thence southwest in a straight line 60 miles to the Bay of Cupica on the Pacific Coast. He, however, stated that this route was impracticable from its great cost, which, he estimated in round numbers, would be $325,000,000. The same route has been more recently surveyed by a U. S. naval expedition under Com. Selfridge, and the general accuracy of Mr. Trautwine's report established. A detailed account of this survey was published in the *Franklin Institute Journal* of 1854.

In 1853 he examined and reported upon the Harbor of Arecibo in Porto Rico; and in the same year was made engineer of the Coal Run R. R. near Mt. Carmel, Pa., retaining this position until the suspension of work in 1855. In the summer of 1854 Mr. Trautwine was so unfortunate as to lose his right arm by having it crushed between two iron coal cars at Port Richmond, Pa., while obtaining their dimensions, these being the first of the kind he had ever seen. This loss of an arm, however, did not compel his retirement from active practice. As he once remarked, "I found it only required practice to write with my left hand, and went ahead as usual." By using weighted straight-edge and squares, and other ingenious instruments of his own design, he made his own drawings in after years and even employed his leisure moments in water-color and oil painting, in which art he was more than an amateur.

In 1856 he made a survey for the Lackawanna & Lanesboro (now Jefferson) R. R., in Northeastern Pennsylvania; and in 1857–58 he laid out a route for an interoceanic railway, 240 miles long, across Honduras. In 1858, at the invitation of Sir John A. Macdonald, Premier of Canada, he visited Montreal, to examine and report upon the proposed harbor and dock improvements. He recommended a plan which has been virtually since carried out, but by his report aroused the opposition of the chairman of the Harbor Commissioners, who was in favor of a much more expensive system of works, and a lengthy controversy followed.

In 1864 Mr. Trautwine prepared plans for a harbor at Big Glace Bay, Nova Scotia.

From this time forward Mr. Trautwine practically retired from the active practice of his profession, and devoted himself to the original investigation of engineering problems, notably the action of retaining walls and arches under pressure. In 1871 he first gave to the engineering world the results of his long years of training experience and study, in the form of an "Engineers' Pocket-book"; the work became at once popular in supplying a want long felt. It has reached its eighth edition, and 20,000 copies are now in the hands of engineers and those associated with them.

Nearly every man has his hobby aside from his profession, and with Mr. Trautwine this hobby was the study of mineralogy. In his extensive wandering and long residence in South America he had accumulated a remarkably fine collection of minerals, especially noted among collectors for the perfection of the different specimens. He enjoyed for years the friendship of Dana, Brush and others eminent in this science. The subject of this memoir was a member of the Academy of Natural Sciences of Philadelphia, the American Philosophical Society, Pennsylvania Historical Society and other learned societies.

Mr. Trautwine died on Friday, Sept. 14, 1883, at his residence in Philadelphia. His final illness seemed to be simply an aggravated state of exhaustion, induced by the undermining of his health in years past by tropical fevers, by which he had more than once been prostrated during his South American service.

His widow survives him, together with three children—Mrs. Chas. MacManus, Wm. Trautwine, and John C. Trautwine, Jr.

CONVICT LABOR ON RAILROADS—THE MARIETTA & NORTH GEORGIA.—The Georgia Legislature Committee are satisfied with the work on this line, and recommend that the company have the use of 250 able-bodied convicts for three years, or until line is completed.

THE CHICAGO ACADEMY OF SCIENCES.

At a recent meeting of this body some interesting communications were made. Mr. William Bross delivered an address on the region of the Canadian Pacific Railroad. He said that British Columbia, for a distance of 1,000 or 1,500 miles north of the United States' border, was a magnificent wheat country. The climate was modified by the Japan stream in the Pacific Ocean, and was much warmer than any other places in that latitude. The country was filling up with great rapidity along the railroad, 400 miles of which were built in one year. He had seen a town there of 3,500 inhabitants, which was only two years old. Beyond Manitoba no liquor was allowed. The red-coats entered the trains and made a search for bottles of whiskey. The result was great sobriety, thrift, and good order in the regions beyond. Dr. S. R. Haven gave an interesting account of a visit he paid lately to the western coasts of Florida, and of some of his explorations in the prehistoric mounds of that country. He found many human skulls, and a large portion of them were perforated in the back part. He subsequently found similar perforations in the conch-shells of the shell-mounds. The holes in the shells, it is thought, were made by the Indians, so that they could blow the conch out and eat it. This suggested to him the theory that the perforated skulls were the skulls of people who had been burned at the stake, and that the holes were made in them so that the cooked brains could be blown out and eaten by the cannibal Indians. Dr. George W. Mason, of Bloomington, gave a brief address of an ancient forest that had been discovered in a coal shaft in McLean County, 170 feet below the surface.

NEGLIGENCE IN THE DELIVERY OF NEWSPAPERS.

The complaint has become frequent that the various employés of the post-office department throughout the country are negligent in forwarding newspapers as directed, and, that there may be greater care given to such mail matter, the following order has been issued from the post-office department: "Complaint has been made to this department that second-class mail matter (newspapers and periodicals sent to regular subscribers) is not in all cases promptly forwarded to the addresses. Such matter is of at least equal importance with the letter mail, and it should be treated with equal care by postal clerks. If it is necessary to withdraw second-class matter from its wrapper in order to ascertain its destination it may be done, but this will not be allowed for any other purpose. The Postmaster-General desires that the practice of reading newspapers and periodicals passing through the mails be discontinued wherever it exists." Another matter of annoyance for which postmasters are responsible occurs in the delivery of newspapers at offices. Unless one rents a box he does not get the papers waiting for delivery to him when he inquires for mail, unless he specially asks for papers. Most people do not know that it is the custom of postmasters to look only at the letters in the "general delivery" upon request for mail, and there is often long delay in the delivery of valued papers. A paper is of no account, thinks the postmaster, and hence his indifference to its delivery. There is a better chance to get mail in the far West, where the post-office consists of a candle box, from which every one helps himself.—*Paper World.*

TESTS OF THE QUALITY OF SOIL WATER.

The Secretary of the State Board of Health of Michigan reports the following:

The question of the fitness or unfitness of soil water for domestic use can be absolutely determined only by a careful chemical analysis. But many persons who would not wish to incur the trouble and expense of a chemical analysis will yet desire some popular means of testing the water they use. The following methods of testing such water are presented, not as the most complete possible, but such as any one can supply without the skill and appliances of the practical chemist. If such tests cast suspicion upon the quality of the water, and especially if the water appears to cause sickness in any one using it, the water should be changed, or else a careful analysis should be made by some competent chemist.

Color.—Fill a bottle made of colorless glass with the water; look through the water at some black object; the water should appear perfectly colorless and free from suspended matter. A muddy or turpid appearance indicates the presence of soluble, organic matter, or of solid matter in suspension. It should be "clear as crystal."

Odor.—Empty out some of the water, leaving the bottle half full; cork up the bottle and place it for a few hours in a warm place; shake up the water, remove the cork and critically smell the air contained in the bottle. If it has any smell, and especially if the odor is in the least repulsive, the water should be rejected for domestic use. By

heating the water to boiling an odor is evolved sometimes that otherwise does not appear.

Taste.—Water fresh from the well is usually tasteless, even though it may contain a large amount of putrescible organic matter. Water for domestic use should be perfectly tasteless, and remain so, even after it has been warmed, since warming often develops a taste in water which is tasteless when cold. If the water, at any time, has a repulsive or even disagreeable taste, it should be rejected.

Heisch's Test for Sewage Contamination.—The delicacy of the sense of smell or taste vary greatly in different individuals; one person may fail to detect the foul contamination of a given water, which would be very evident to a person of a finer organization. But if the cause of a bad smell, or taste, exist in the water, the injurous effect on health will remain the same whether reconized or not. Moreover, some water of very dangerous quality will fail to give any indication by smell or taste. For these reasons I attach especial importance to Heisch's test for sewage contamination or the presence of putrescible organic matter. The test is so simple that anyone can use it. Fill a clean pint bottle three-fourths full of the water to be tested, and dissolve in the water a teaspoonful of the purest sugar—loaf or granulated sugar will answer—cork the bottle and place it in a warm place for two days. If in twenty-four to forty-eight hours the water becomes cloudy or muddy it is unfit for domestic use. If it remains perfectly clear it is probably safe to use.

NEWS OF THE WEEK.

A DRIED-UP WATER COMPANY.—The residents of Vallejo, Cal., are suffering from a scarcity of water. The source formerly relied upon by the Vallejo Water Company has been Lake Chabot, an artificial lake about three miles from town, but owing to an insufficiency in the rainfall the lake recently became dry, and has not now in it a drop of available water. The company accordingly brings water in barges from above Antioch down the Sacramento River. Mare Island is well supplied, but the town is not, and water here is at a premium. As a result, the Chinese laundries have advanced the rates for washing, and all over the town the inhabitants are sinking artesian wells, so as to become independent of the company.

A DEEP ARTESIAN WELL.—The artesian well now being drilled in the cellar of Cyrus W. Field's new building at No. 1 Broadway will be one of the deepest and largest in this country, and the tools used are among the heaviest ever made for this purpose. The bore is 8 in. in diameter, the usual size being from 4 to 6 in. The hole in this well is between 300 and 400 ft. deep, and progress is being made at the rate of 100 ft. a week. An abundance of water has been reached, but not in sufficient quantity to justify a discontinuance of the drilling. The auger and bit weigh 4,800 pounds and are lowered into the hole by a cable. One end of the cable is attached to an immense walking-beam, by which it is raised and let fall with every puff of the engine, shaking the building with each stroke. A man stands constantly at the mouth of the well, turning the cable as the bit is raised, so that the boring is as perfectly done as if the rock were of pine and the auger of steel. The hole is round and smooth and almost polished by the constant friction. Every few hours the auger is drawn out and a large brass syringe inserted to suck out the rock sand which is made by the drilling. The bits are constantly being dulled by rocks, and a blacksmith's forge is necessary to sharpen and temper them to their work. One bit lasts usually about four hours, when it is removed and another one put in its place. Mr. C. J. Bushnell, the contractor for the work, estimates that the well will cost nearly $15,000 and will yield about 50 gallons of water per minute.

THE NEW YORK & BOSTON INLAND ROAD.—BOSTON, Sept. 20.—The incorporators of the New York & Boston Inland Railroad Company announce that their preliminary work is completed, that their construction contract is signed, and that the road will be built as quickly as capital, brains, muscle and machinery can accomplish the great work. The New York Construction Company, which has surveyed the route, obtained the charters in the several States, and secured a location in each city and town, has concluded a contract with Samuel H. Linn, of St. Petersburg, and W. F. Mason McCarty, of Moscow, Russia, who form the firm of Linn & McCarty, of New York, whereby the line is to be built before Sept. 12, 1886, at a cost of about thirty millions. The intention of the originators of this scheme is to build a double-track, steel-rail air-line road for fast passenger traffic, having termini in this city in the Boston & Providence station, and in New York in the Grand Central Depot. Three and a half hours is the time which they expect their trains to occupy in traversing the distance. The statement is made that the capital which is to be invested in this enterprise is to come from the money kings of London and Paris. The contractors are now riding over the proposed route, and are, it is said, to begin work next month at both ends of the line.

RAILROAD EXTENSION.—A corps of engineers in charge of Chief Engineer Wood, of the New York, Susquehanna & Western Railroad Company, is now surveying a line for the extension of that road from the Delaware Water Gap to Port Jervis, a distance of between forty and forty-five miles.

DETROIT, BAY CITY AND ALPENA RAILROAD.—Surveyors have started from East Tawas, Mich., to locate a line between there and Ausable. The line will be begun at once.

THE MAXWELL LAND GRANT SURVEY.—The Commissioner of the General Land Office has appointed an agent to examine the survey of the Sangre de Christi, or Maxwell, land grant in Colorado. Suit is now pending in the United States Court of Colorado to vacate the patent on the ground of fraudulent survey, and the examination of the agent is to be made to determine that point. The amount involved, and in which the United States are interested, is about $2,000,000. The result of the agent's investigation will be used as evidence in the case.

OPENING ONE LINE—BEGINNING ANOTHER.—The first branch of the Texas & St. Louis, running from McNeil to Magnolia (Ark.), has been opened. The branch to Little Rock will be next built.

THE Anderson to Shelbyville (Ind.) extension of the Cincinnati, Wabash & Michigan will be probably built, as $100,000 of subscriptions have been secured.

MISSISSIPPI RIVER IMPROVEMENTS.—Major O. E. Ernst, of the United States Engineer Corps, reports the following progress on river improvements during August:

Horsetail Bar—In the hurdle to connect the head of Carroll's Island with the Illinois, 77 piles were driven, 37-ft.-long terminal stringers and 190 diagonal braces were placed, and 1,650 linear ft. of matting was placed.

Twin Hollows, west bank—The repairs in secondary hurdles 3, 4 and 5 were completed. Matting in the primary hurdle was repaired for a length of 1,120 ft. In secondary hurdle No. 1 220 piles were driven, 6 braces were placed, 800 linear ft. of foundation mattress was fabricated, of which 700 were sunk.

Chesley Island—In the hurdle to close the chute west of the island 125 piles were driven, 57 stringers and 134 braces were placed, 160 linear ft. of matting was placed and 215 linear ft. of foundation mattresses were fabricated and sunk. In the revetment of the east side of the island riprap was deposited upon the bank above low water for a length of 640 yds.

Jim Smith's—In the primary hurdle 322 piles were driven, 36 stringers and 55 braces were placed and 1,250 linear ft. of foundation mattresses were fabricated and sunk.

Foster's Island—The revetment of the west side of the island was begun; 59 guide-piles were driven and a mattress, 120 ft. wide, to be placed below low water mark, was begun, and at the end of the month had reached a length of 99 ft.

Surveys—The gauges at Grafton and Gray's Point were read daily.

Improvement of the channel opposite St. Louis—In hurdle No. 1, across Cahokia Chute, 61 piles were driven, 37 braces were placed, 300 linear ft. of foundation mattresses were sunk and 650 linear ft. of matting were placed. In hurdle No. 2, 400 linear ft. of matting were placed. Both hurdles were thus completed and work discontinued.

THE Edison Company for Isolated Lighting announce that they have erected 199 plants, aggregating upward of 44,786 lamps, and that there have been installed by other Edison companies in various parts of the world 158 plants, with about 26,929 lamps, thus making 357 isolated plants, with a total of 71,715 lamps.

THE ELECTRIC LIGHTING of H. M. S. Malabar, which has been carried out by the Edison Company, is effected by means of sixteen circuits, upon which there are fixed 112 full lamps (16 candle-power), and 295 half lamps (8 candle-power). There are 12 full lamps in the engine room, 16 in the boiler room, 7 in the shaft alley, and 47 in the upper saloon; 21 half lights on the seamen's mess deck, 54 over the troops' mess tables forward, 27 in the saloon, 30 on the lower troop deck, and 32 on one of the yardarms.

SAND AS A MOTIVE POWER.—In Nevada the scarcity of water has prompted the use of sand to drive an overshot wheel. A windwheel runs a belt containing a large number of baskets, and these carry the sand into a large tank, and a large stream of sand is allowed to fall on the overshot wheel, which operates just the same as water. When there is much wind sand is stored up for use when calm prevails, so the machinery is never idle. After a sufficient quantity of sand has once been accumulated, there is no more trouble on that score, the same sand being used over and over.

THE FLORIDA SHIP CANAL.—At a meeting on Tuesday of the stockholders of the Florida Ship Canal and Transit Company at No. 71 Broadway the Board of Directors were authorized to make a contract for the construction or the canal, to issue first mortgage bonds, to issue stock for the promotion of the work, and to take all the steps necessary for beginning actual work upon the canal at the earliest possible day. It is understood that several responsible parties are ready to make proposals which will be submitted to the Board of Directors at an early meeting. A member of the board said that the eastern terminus of the canal would be in the vicinity of the mouth of the St. John's River, and the canal would run across the neck of the peninsula at its narrowest part. It will be 136 miles long, 280 ft. wide, and 30 ft. deep, so that two steamers of 3,000 tons burden each will be able to pass each other without any siding.

PIPE-BENDING MACHINE.—A patent has lately been secured for a pipe-bending machine, an article that has been produced long after an urgent demand for such a device was felt in every pipe-fitting shop in the world. Pipe-bending, although in constant operation, has been done by the most awkward forms of mechanical make-shifts, the consequence being that a great many pipes are permanently injured by the rough act of bending. The new patent appliance for pipe-bending consists of a collar to receive the end of the pipe, from whence it is drawn round a circular groove by a roller attached to a bifurcated lever. The machine looks capable of doing the required work. It is patented by Robert Reach, Washington, D. C.

SHEBOYGAN (WIS.) WATER-WORKS.—The authorities of this city are moving to obtain a public water supply. The population is 8,500; source of water supply Lake Michigan; mode of supply "*must be* direct pumping;" 8 to 10 miles of main pipe will be required. Wm. Elwell, Esq., is the Secretary of the Committee who has the matter in charge. His address is Sheboygan, Wis.

MR. VILLARD'S NEW ROADS.—It is stated in San Francisco that the recent large expenditure in improvements of the South Pacific Coast Railroad and the construction of a new pile road, two miles out into the bay, has been prompted by a new corporation called the San Francisco and Colorado Railroad Company, with Villard at its head, and that he has bought the Northern Pacific Coast Road, running from San Francisco north along the coast to a point called Duncan's Mills, with the intention to continue it to a junction with his Oregon system. It is further stated he has bought the Santa Maria Valley Railroad, a short line running from Port Horfort to Santa Barbara, and that he intends to build a connection to join the South Pacific Coast Road. With this accomplished, he would have a continuous coast line from Puget Sound to within a short distance of San Diego, Southern California, a distance of 1,500 miles.

ELECTRIC LIGHT FOR FREIGHT YARDS.—The New York Electric Light Co. has made a contract with the Pennsylvania Company for lighting the Allegheny yard. The trial is to last sixty days, and if successful, the light will be used at other points.

READING (PA.) WATER.—The chief causes of the impurity of Reading's water are said to be a leak which admits filth at the bottom of the tower in the Antietam Reservoir and the dirty condition of the street mains. The Water Board has undertaken to remedy the evil.

HYDRAULIC MINING IN CALIFORNIA.—Hydraulic mining is rapidly destroying the navigation of the rivers of California. Just below Sacramento a big sand bar has formed, so that a loaded steamer drawing only four and a half feet of water grounded this week and only got off with difficulty. Ten years ago deep-sea vessels could pass this place, where, it is estimated, the deposit of mining debris now reaches a depth of twenty feet. Yuba River has been so filled up that the smallest boat cannot get to Marysville except when there is a flood, though formerly big boats ran there. Feather River is virtually closed to navigation all the year, because of formidable bars. San Francisco Bay suffers also, and a large part near the mouth of the Sacramento has been so badly filled up as to make navigation dangerous.

THE NEW LOWELL (MASS.) BRIDGE has been opened to public travel.

MUST ADVERTISE FOR BIDS.—When the bill of the I. P. Morris Company for steel valves, amounting to $4,254, came up for approval, Councilman Clay asked how that firm obtained the contract. Chief Engineer Ludlow explained that in such cases the department was in the habit of sending out circulars to the trade and then buying of those whose rates were the lowest. Mr. Clay read the law and the ordinance showing that all supplies for any city department should be publicly advertised for and bought from the lowest bidder and asked whether there had been any advertis-

ing in the case under consideration. Colonel Ludlow said there had not, unless the sending of the circulars had been an advertisement. Mr. Clay replied that the terms of the law were explicit and that the circulars did not meet them. On his motion the bill was held over for consideration.—*Philadelphia Times.*

IRON AND TIN WORK OF ROOF AT MONTGOMERY, ALA.—The following is an abstract of the bids for iron and tin work of roof of the post-office and court-house at Montgomery, Ala., opened Sept. 14 1883.

D. W. Stockwell, $2,269.50.
I. S. Thorn, $3,100.
John Siddon, $3,138.87.
David Ingleham, $8,678.
Wm. Nails, $5,440.
W. R. Kinnear & Co., $2,700.
The award has not yet been made.

DREDGING NOMINI CREEK, VA.—The following is an abstract of the bids received for dredging Nomini Creek, Va., opened Sept. 12, 1883.

Henry Birch, Washington, 19 cents per cubic yard.
Thomas P. Morgan, Washington, 19 1/10 cents per cubic yard.
James Calar & Son, Norfolk, Va., 32 cents per cubic yard.
The contract has been awarded to Henry Birch, the lowest bidder.

RIP-RAP GRANITE FOR NANTUCKET HARBOR.—The following is an abstract of the bids for furnishing rip-rap granite for the jetty at the entrance to Nantucket harbor, opened September 9, 1883:

C. H. Edwards, Boston, Mass., $3.60 per ton for 1,000 tons, and $2.20 for remainder.
James Scully, Croton, Conn., $2.25 per ton.
John Beattie, Leetes Island, Conn., $2.53 per ton.
Frederick Ballou, Mystic Bridge, Conn., $2.77 per ton.
The contract has been awarded to Charles H. Edwards, Boston, Mass.

DREDGING CORSICA CREEK.—Abstract of proposals for dredging Corsica Creek, near Centreville, Md., opened September 15, 1883:

Frank Pidgeon, Jr., New York, 41 cents per cubic yard in scows.
American Dredging Company, Philadelphia, 18 cents per cubic yard in place.
Thomas P. Morgan, Washington, 10 cents per cubic yard in scows and 24 cents per cubic yard in place.
James Baler & Son, Norfolk, Va., 29 cents per cubic yard in scows.
Daniel Constantine, Baltimore, 16 cents per cubic yards in scows.
The contract has been awarded to the American Dredging Company.

FURNITURE FOR PUBLIC BUILDING AT ST. LOUIS.—The Robert Mitchell Furniture Company was the successful bidder for furnishing the furniture for public building at St. Louis, Mo., their bid being $17,708.97.

A CITIZEN OF ROME, Ga., while crossing the railroad tracks in that city, got his foot caught fast in a frog. While trying to get loose he saw the Chattanooga train on the East Tennessee, Virginia & Georgia road come dashing over the bridge. Wild with fright, the man jerked his leg almost out of joint, and came near breaking his foot. But the train was almost upon him and he decided to unlace his shoe, pull his foot out, and leave the shoe to be mashed. He acted upon this thought, and as he got his foot out the train glided by on another track.

POWER OF BELTING.—Horse-power of a belt equals velocity in feet per minute, multiplied by the width, the sum divided by 1,000.

One inch single belt, moving at 1,000 feet per minute, 1 horse-power.

Double belts about 700 feet per minute, per 1 inch width, 1 horse-power.

For double belts of great length, over large pulleys, allow about 500 feet per minute, per 1 inch of width per horse-power.

Power should be communicated through the lower running side of a belt; the upper side to carry the slack.

Average breaking weight of a belt, 8-16 by 1 inch wide, leather, 530 pounds; three-ply rubber, 600 pounds.

The strength of a belt increases directly as its width. The co-efficient of safety for a laced belt is:

Leather—1-16 breaking weight.
Rubber—1/4 breaking weight.

WHERE THE NATURAL GAS SUPPLY IS TO BE FOUND.—Mr. Asa P. Wilson, of Pittsburgh, Pa., who is considered an authority upon such matters, says that the territory in which the greatest flow of natural gas may be obtained will be found within a belt extending from a point on Lake Ontario in a direct line to West Warren County, Pennsylvania, thence directly to Rochester, Pa., down through Steubenville, Wheeling, W. Va., Parkersburg, W. Va., to Boone County, West Virginia, this line forming the northwestern boundary. A similar line running 80 miles east, starting from Lake Ontario and ending after the Great Kanawha River is crossed, will embrace the area of the most productive gas territory. A continuation of this belt, but much narrowed, through Kentucky and Tennessee into Alabama will produce in many places large flows of gas. Sections of Wisconsin, Michigan and Illinois are also likely to produce remunerative gas wells.—*American Gas Light Journal.*

A DEEP ARTESIAN WELL.—The artesian well at White Plains, Nev., is now down to the depth of 2,500 feet. Fresh water has been struck in the well, but it does not rise to the surface. The well will be sunk a thousand feet deeper if flowing water is not found sooner.

A PROJECTED MAINE ROAD.—A meeting has been held at New Portland in aid of a railroad from South Story to North New Portland. It is to be called the Franklin & Somerset.

MCPHERSON (Kansas) has built waterworks for protection against fire. The cost was only $9,000.

THE NEW ORLEANS & MISSISSIPPI VALLEY ROAD.—The President of the road, and Capt. Grant, Chief Engineer, have been lately inspecting the part of the line completed.

NEW BRIDGE.—A bridge 16 ft. wide and 1,120 ft. long is to be built across Barnegat Bay before Nov. 1. Its location is just south of the Metedeconk River. Ocean County pays one-half of the cost.

CONTRACT LET.—The contract for grading the extension of the Milwaukee & St. Paul's Chippewa Valley branch to Chippewa Falls has been let to O'Hara Bros., Eau Claire (Wis.)

A BELT LINE FOR OMAHA.—A belt line company with a capital of $800,000 has been incorporated. A survey has been made.

THE WYANDOTTE BRIDGE.—The Kansas City Bridge & Iron Company sent in a revised bid of $25,000, which was accepted.

THE Springfield & Southern Railroad is being actively promoted.

ST. LOUIS MARINE HOSPITAL CONTRACT.—The contract for the construction of the Marine Hospital buildings at St. Louis has been awarded to Nolk & Tacke, of that city, at $27,550.

THE Galveston, Sabine & St. Louis will, it is thought, be extended from Easton to a connection with the Bremond narrow gauge at Nacogdoches.

GRANITE OR WOODEN PAVEMENTS.—Residents of Franklin avenue, St. Louis, are divided as to the relative merits of the above.

NATURAL GAS.—STEUBENVILLE, Sept. 12.—Gas was struck at the Jefferson Iron Works' well to-day, at the depth of 1,235 ft. The vein is not a full flow, but is sure evidence that a full flow will be struck.

THE Lehigh Tunnel will, when completed, be about 4,000 ft. long.

THE Brush Electric Light is thought too dear in Cincinnati, a proposition to light Washington Park having been rejected.

JAMES RIVER VALLEY RAILROAD.—Ground has been broken on this road which is to run south to Grand Rapids and connect there with Milwaukee or Northwestern.

ROCHESTER is to have a suburban road to Hemlock Lake. A survey has been made, and the expense of constructing a narrow-gauge road from Rochester to Hemlock is estimated to be $300,000. The route of the new road will be through the villages of East Henrietta, East Rush, Honeove Falls and Lima, to Hemlock Lake.

A CHICAGO ELEVATED ROAD.—The Chicago & Central Elevated road has been incorporated. The line is to extend to Riverdale, Englewood, Washington Heights, Norwood Park and Proviso suburbs south of the city.

WILMINGTON'S RIVAL WATER-WORKS. — WILMINGTON, Del., Sept. 17.—In the Superior Court this afternoon counsel for the Water Commission created by the last Legislature submitted affidavits reciting that the pre-existing Water Department of Wilmington is still holding possession and exercising control, in defiance of legislative enactment, and moving that a rule issue upon the Water Department to show cause why a peremptory mandamus should not issue against it. Counsel for H. B. McIntyre, the Chief Engineer appointed by the Water Commission, also submitted a motion for a rule to show cause why a writ of quo warranto should not issue against David H. Coyle, the chief Engineer in possession, to show cause why he holds his office. Both rules were granted and made returnable on Thursday next.

LOW WATER IN NEW ENGLAND.—The Merrimack River is so low that mills have had to stop.

THE DENVER WATER CO. AND THE ARTESIAN WELLS.—The Water Company has made a reduction of 60 per cent. on all buildings containing more than five rooms. The company think that the reduction will put a stop to artesian well-boring, as the company propose to sink a sufficient number of wells to supply the entire city through the Holly water-pipes. The difference in quality of the two kinds of water is so marked that the people will only use the artesian. The magnetic properties of the artesian water of Denver are among the most important advantages of the system. All the wells are more or less impregnated with magnetism, though its presence has been attributed to the friction of the tool-tubing. It has been proved, however, that it is owing to the magnetic quality of the water.

LEAVENWORTH PEOPLE (Kansas) are agitating for a new bridge.

BUILDING IN CHICAGO.—The Chicago *Tribune* says: "The season thus far has not been a busy one for architects or builders, although it would appear that there is a large amount of building going on all over the city. Few new plans are being drawn for large structures, and it is quite likely that very little will be done of an important character this fall."

OMAHA'S WATER-WORKS.—Omaha boasts of having the most complete system of water-works of any city in the world. They have a pumping capacity of nearly 20,000,000 gallons per day, besides two large reservoirs, each of which is capable of holding a two weeks' supply.

THE SIOUX CITY AND PACIFIC RAILROAD BRIDGE across the Missouri River at Blair is being constructed as rapidly as possible. The main line of this system is in operation to Valentine, in northern Nebraska, and will be continued on directly westward, with the future destination a matter of some speculation. A branch will be built nearly due north, penetrating the Black Hills country.

A LARGE GLACIER IN MONTANA.—The Northern Transcontinental Survey party have discovered a glacier, having a frontage of at least a mile and at some places a face 500 ft. in hight, in the upper Marias Pass, in Montana, near the headquarters of the upper Flat-head River, west of the Rocky Mountains.

THE pay of Krupp's hands at Essen is not very high, but is partly compensated for by other facilities. R. K. Porter in a recent letter says: The firm of Fried. Krupp at present owns 3,250 well-built and to all appearances healthy dwelling-houses, in which over 16,000 individuals are living. The buildings have two and three floors, and are constructed partly of stone and partly of frame-work, and are surrounded as much as possible with gardens. The single dwellings, which, besides cellarage and garret, have from two to four rooms, are self-contained and separated from the other dwellings. The letting to lodgers is permitted only in dwellings of three to four rooms, and must receive the special permission of the central committee appointed for maintaining cleanliness and order. The annual rent for the family dwellings varies as follows:

	Per year.
For two rooms in lodging-house or barrack house.	$15 to $22
For two room house with cellar.....	22 to 27
For three room house with cellar.....	30 to 40
For four room house with cellar	45
For five room house with cellar.....	59

Thus for $1, or about four shillings a week, the usual price for small cottages in the industrial districts of England, the German artisan at Essen can rent a large house and garden, while for 1s. 2½d. the British workman could not get a room. The Dundee pigstyes and the hovels of South Wales rented for 2s. 6d. to 3s. a week.

The single men at Krupp's are provided for in a large boarding house capable of keeping 1,800 boarders, at a cost of about 80 pfennings (20 cents) a day. bread not included, making the probable cost about one mark, or about 25 cents per day. Herr Klupfel, the director, who has charge of the labor department at Krupp's, told me that no men were now being paid less than 3 marks a day (about 75 cents). This of course to the unskilled laborer. Skilled labor is paid from 3½ marks to as high as 7 and even 9 marks a day for skilled mechanics in the machine shops, but this was of course exceptional, the wages not often exceeding five marks, or a little over one dollar American money. For these same classes of labor the American manufacturer probably pays $2.50 or $3 and even $5 a day.

THE DENVER ROAD.—It is again the saying that Lovejoy will be the president of Denver, and the company be put in good shape financially.

THE PHILADELPHIA STEAM SUPPLY CO.—A subcommittee of the Philadelphia joint committees of law and highways have accepted an invitation to visit New York and examine the workings of the Philadelphia Steam Supply Co.'s system here. This company is to give a bond of indemnity of $10,000 for each mile of street occupied, and guarantees that the system is free from all defects.

THE WESTINGHOUSE AIR BRAKE.—The Indianapolis *Journal* says that a gentleman of that city ten years ago purchased $780 worth of stock of the Westinghouse Air Brake Company. The first year he held it he received a 10 per cent. dividend, the second year a 10 per cent. dividend in cash and a 30 per cent. dividend in stock. From 1875 to 1881 he received a 10 per cent. dividend on his

stock annually. In 1882 he received a 60 per cent. dividend, and he this week received notice that an 80 per cent. cash dividend has been declared. His dividend this year will be over $1,000 in excess of the original cost of his stock. While the Westinghouse company has constantly been enlarging its works and making improvements to the brake, the dividends have been surprising the stockholders.

THE PUEBLO SURVEY.—A motion for hearing filed by the Attorney General of California in the case of the survey has been received at the Interior Department Washington.

CONTRACT FOR DRAINAGE.—HAVANA, Ill., Sept. 14.—The contract for the great Mason & Tazewell Drainage Canal has just been awarded to W. A. McGillis & Co. This is the greatest work of the kind ever undertaken in Central Illinois. The cost will be $200,000. Three dredgers of the best pattern have been ordered, and work will commence as soon as possible at the county line and work toward the Illinois River. Over 150,000,000 cubic yards of earth will be removed.

GAS WELLS IN ILLINOIS.—A dispatch from Tolono states: "For eighteen months past H. C. Smith has been heating and lighting his residence in this city with gas obtained from a well about 2 in. in diameter and 160 ft. deep. Since Mr. Smith's experiment demonstrated the practicability of using gas thus obtained for heating and lighting purposes, a dozen or more gas wells have been sunk by other parties in this locality. In almost every instance a vein of gas has been penetrated at a depth of about 100 ft. below the surface; but in most cases the flow of gas has been too weak for use, and up to this week C. E. Bowman, living three miles northeast of town, has been the only person in the township besides Mr. Smith whose well supplied a sufficient quantity of gas for continual use. The excitement, which was at its height six months ago had nearly died out, and interest in the subject had reached the minimum; but the whole matter has just received a new impetus by the discovery at the farm of C. R. Wyman, in Philo township, three miles northeast of Tolono, of a vein of gas more abundant and powerful than any which had been previously found.

GREAT BRIDGES.—The new bridge across the Firth of Forth, now building, will, when completed, be among the most remarkable bridges in the world. The main girder will be within a few feet of a mile in length, and will rest upon round cylindrical piers, each of which will weigh 16,000 tons. It will, of course, be high enough for all vessels to pass underneath, and about 42,000 tons of steel will be required in its construction. The estimated cost will be $7,500,000.

China possesses the longest bridge in the world. It is at Langang, over an arm of the China sea, and is 5 miles long, 70 feet high, with a roadway 70 feet wide, and has 300 arches. The parapet is a balustrade, and each of the pillars, which are 75 feet apart, supports a pedestal on which is placed a lion, 21 feet long, made of one block of marble.

The highest bridge in the world is said to be the railway viaduct at Garabic, in France, now being erected over a river in the Department of Cantal. The bridge has a total length of about 1,800 feet, and near the middle of the great centre arch, which is one of the noteworthy features of the structure, the height from the bed of the river to the rail is 418 feet.

The Erie railroad bridge at Kinzua, near Bradford, Pa., is also an astonisher. The greatest elevation of the bridge (301 feet) is 18 feet higher than the spire of the Trinity Church, 24 feet higher than the summit of the Brooklyn Bridge towers above high water, 143 feet higher than their elevation above the roadway, and 82 feet higher than Bunker Hill monument. The bridge is 2,052 feet long.

The Brooklyn bridge is 5,989 feet long; clear neight in center of river span, 135 feet; length of river span, the longest span in the world, 1,595 feet.—*Ex.*

THE NASHVILLE, CHATTANOOGA & ST. LOUIS EXTENSIONS.—The report of the President says: "The grading for the extension from Rock Island to Sparta has been completed, together with the piers of Caney Fork and Town Creek bridges. The superstructure of those bridges and track-laying will be finished during the present year. Continued high water has prevented the prosecution of the work until a short time ago. The Jasper Branch has been extended from Victoria to Inman, 5 3-10 miles, under the agreement made with the Tennessee Coal & Iron Railroad Company. It was built by that company and conveyed to the Nashville, Chattanooga & St. Louis Railway. The management of this company, however, in view of the class of traffic—iron ore—that would pass over the road, and the heavy engines necessary to move it economically, determined to ballast the road-bed, and lay it with steel instead of iron rails. The Centerville branch has been completed to Duck River, opposite Centerville, a distance of thirty-four miles from Dickson, where it connects with the Northwestern Division; and in accordance with contracts previously entered into between the Nashville & Tuscaloosa Railroad Company and your company, this thirty-four miles has been conveyed to the Nashville, Chattanooga & St. Louis Railway in fee simple.

An agreement to extend this road to the Lewis County line, thirteen miles, was entered into on Dec. 16, 1882, between the Ætna Manufacturing, Mining & Oil Company and your company. Work has been commenced; the piers of the bridge over Duck River and the grading of the road from Centerville to the Lewis County line is rapidly nearing completion.

DAMAGES BY FLOODS IN TEXAS.—Superintendent Herrin, of the International Railroad, has returned from Laredo, where he has been supervising repairs said to be necessary on account of late heavy storms, rain and floods on the Rio Grande frontier. Near Encinal Station about 2,000 ft. of embankment, averaging 5 ft. high, was swept away by the force of the flood. Many bridges along the road were damaged, tracks washed out and culverts swept away. A large force of men was promptly on the ground under Superintendent Herrin's direction, and the road is in good condition now. The Rio Grande & Pecos Railroad, running from Laredo to the coal mine of ex-Govenor Hunt, was badily damaged, all the bridges to the Rio Grande were down, and on the Texas Mexican Railroad the bridge at San Diego is ruined.

KANSAS CITY (MO.) LAW FOR CONTRACTS.—At a recent meeting of the City Council an amendment to the ordinance on contracts was introduced by Alderman Ford, providing that all persons who bid on public works shall file an acceptance bond of $200 on all works costing less than $2,000, and all bids for work costing more than that sum shall be accompanied by $200 in cash, which shall be forfeited in case the bidder to whom the contract is awarded fails to execute his contract. After a good deal of discussion the ordinance was passed.

RAPID CITY CENTRAL RAILROAD.—A board meeting of the directors of the above railway was held at Rapid City, Manitoba, on Saturday the 18th, when matters were arranged for the immediate commencement of construction operations. Mr. Patterson, of Brandon, has taken the contract for the first twenty miles, and will put sixty horses on the grading work at once, and all the men he can engage. After harvest he will put on a force of over 200 men, so that he may complete his contract this fall if possible, or at least as much of it as the bonus by-law demands, which is to the boundary line of the municipality, a distance of seventeen miles.

THE MICHIGAN CENTRAL'S BRIDGE.—The Witmer heirs are the owners of the land necessary to be taken by the Michigan Central Railroad Co. for the piers and approach to its cantilever bridge across the Niagara River at the American end. A contest has been carried on for several weeks in the courts, the heirs contesting the proceedings of the company. Judge Haight, at Special Term, in Lockport, has just appointed the following Commissioners of Appraisal: The Hon. John E. Pound and T. T. Flagler, of that city, and the Hon. S. Nielson, of Niagara Falls. They will meet at Suspension Bridge, Sept. 24.

A NEW CALIFORNIAN ROAD.—The proposed Los Angeles & San Gabriel Valley Road will cost some $300,000.

THE LYNN (MASS.) WATER-WORKS.—President James N. Bufford of the Water Board and Mr. Phinehas Ball, Civil Engineer, have selected Mr. W. C. Boyce, of Worcester, as Constructing Engineer for the new system of water supply in connection with Saugus River, and Mr. Boyce and Mr. Ball have commenced work.

GAS AS A MOTIVE POWER.—The experiment of gas as a motive power is being tried in the jewelry department of the watch factory at Waltham.

ELECTRIC LIGHT IN MINNESOTA.—The Brainerd Electric Light Co. has been incorporated at St. Paul.

EARLY RAILROAD BUILDING IN COLORADO.—To the Colorado Central belongs the credit of being the pioneer railroad of Colorado. It was the first chartered in 1865. The proposition for the charter was vigorously fought in the Legislature, particular stress being laid upon the assumption that a railroad up the steep mountain grades was a practical impossibility. The projectors were declared to be visionaries and cranks for advocating such a scheme. However, the charter was granted, and the first ground broken in 1867. In 1870 the road was completed from Denver to Black Hawk and up the south fork of Clear Creek to Floyd Hill, about four miles above what is now the station of Forks Creek. The switch-back from Black Hawk to Central, with a grade of 400 ft. to the mile, was built in 1877, and the line to Georgetown was completed in 1878. A broad gauge line was completed from Golden to Boulder and Longmont in 1873, and in 1877 this line was extended to a junction with the Union Pacific at Cheyenne, competing with the Denver Pacific road. The incorporators of the road were all pioneers; and they are the men who, with their supposed visionary scheme, demonstrated the practicability of traversing the mountain regions with railroads, in spite of the most discouraging predictions of failure from experienced engineers in all parts of the country.—*Denver Tribune.*

IRON AND STEEL MARKET.

PHILADELPHIA, SEPT. 20.

Heavy buyers of pig iron are still holding back, waiting for concessions on offers submitted for large stocks, to run them up to the end of the year. On some brands of foundry prices have been reduced, but for forge prices are well maintained. Average foundry quotations $20@$22. Small lots are moving every day at 50c. higher. Forge averages $17.50@$18 at furnace. Large sales are exceptional. The supply is sufficient to prevent any upward tendency, and offers are submitted for inferior brands at lower than current rates. The sales of Scotch iron for the past week have been restricted to small lots. Negotiations for Bessemer pig have been suspended, owing to the refusal of sellers to meet buyers' views. Quotations, $21@$21.50. Sales of 1,000 tons of Speigeleisen were made at $31.25. All kinds of rolled iron excepting bars, are in active demand. Prices firm at old rates. Mills are full of orders and the outlook encouraging. Requirements for winter have been called for, but offers made at concessions are not accepted. Bar mills are fairly supplied with orders for early delivery. Some buyers are looking for Western iron. Steel rails are quiet, and prices are unchanged at $37@$38, with the usual inquiry for heavy lots for winter delivery. American old rails are being offered for delivery here at $23.25. Foreign rails are not in stock, and no orders are going abroad.

PITTSBURGH.

The rolling mills throughout western Pennsylvania are generally at work filling current orders for retail lots at 1.80@1.90c., with common iron at 1.75c. The fall business is coming in a little more freely, but large buyers are not placing orders, on account of the uncertain character of the trade after the first of next month. The plate and shaped iron mills are full of orders, and have as much business as ever, at firmer prices. A large amount of pipe is under negotiation, and the pipe mills look forward to an active winter to meet the new requirements which are coming forward. The Bessemer mills are quiet; rails, $37@$38. Sheet mills are busy; muck bars, $33.50; foundry pig iron, $19@$22; mill irons, $17.50@$19. The miners are agitating for an advance, Oct. 1, and the reinforcement of the checkweighman law.

The window glass manufacturers are holding meetings almost daily, preparing to fight their workmen against the proposed advance. Every manufacturer has given his promise to stand to the dictum of the association, and refuse to make terms. Large orders for glass for western buyers are going eastward, and an advance is contemplated in Philadelphia next week.

Great interest is felt in the natural gas problem, and several iron manufacturers have purchased property on the Ohio, below Pittsburgh, for the purpose of boring. If the gas is found it will be used in many of the Allegheny River mills. Another well is to be bored at McKeesport.

The coal and coke trades are improving and the demand for both products is increasing in eastern and western markets.

CHICAGO.

The general condition of trade is satisfactory, but its volume has not increased to the usual Fall dimensions. Merchant steel is in fair demand and prices are strong, excepting in low grades, on account of the competition of Bessemer steel. Steel rail mills are taking orders at $39@$40, and report numerous inquiries for Winter deliveries. The pig iron market is stronger, and larger sales are being made in foundry and mill irons. Charcoal and Southern irons are in good demand. The volume of inquiry for all kinds of pig is improving, and brokers think they have turned the corner of low prices. Nails are quoted at $3@3.05; demand is light, owing to the expectation of a further decline, on account of the heavy production. Numerous orders are coming in for galvanized iron for building purposes. Dealers' stocks are still large. Russian iron is scarce, and stocks in Eastern markets are reported light. Manufactured iron is dull at 2.05@2.10c. Hoop is weak and quiet; structural iron is in good demand; tank, 2.70@2.80c.; angles, 2.90c.; Beams, 3.60c.

The demand for anthracite coal in this market is increasing, and inquiries are going Eastward for large deliveries during the rest of the year. Yards are very fairly supplied, but dealers expect an urgent manufacturing demand, which will absorb all the stock they are able to deliver.